151893

FINAL

REMEDIAL INVESTIGATION REPORT
VOLUME 1 OF 2

ECC SITE

ZIONSVILLE SITE

WA18.5L30.0

March 14, 1986

GLT424/135-2

CONTENTS

CONTENTS (continued)

FIGURES

CONTENTS (continued)

CONTENTS (continued)

CONTENTS (continued)

TABLES Page

Chapter 1
EXECUTIVE SUMMARY

BACKGROUND

The Environmental Conservation and Chemical Corporation (ECC) site is in Boone County, 865 south U.S. 421, Zionsville, Indiana, about 10 miles northwest of Indianapolis. The site occupies 6.5 acres alongside the 168 acre Northside Sanitary Landfill (NSL), an ongoing solid waste disposal facility. The ECC site is bounded on the south and east by the landfill. An unnamed ditch separates the two facilities along the east boundary. The site is bounded on the north and west sides by several residential homes, located within one-half mile of the facility.

ECC began operations in 1977 and was engaged in the recovery/reclamation/brokering of primary solvents, oils and other wastes received from industrial clients. Waste products were received in drums and bulk tankers and prepared for subsequent reclamation or disposal. Reclamation processes included distillation, evaporation and fractionation to reclaim solvents and oil.

Accumulation of contaminated stormwater onsite, poor management of the drum inventory and several spill incidents caused initial state and EPA investigations that later led to civil suits and finally placement of ECC into receivership in July 1981. Drum shipments to the site were halted in February 1982. The company was found insolvent in August 1982 and the state and EPA began plans for cleanup. Numerous site investigations, including sampling and analysis were conducted during the period.

Removal measures at the site began in March 1983 and continued through 1984. Actions included removal and treatment or disposal of cooling pond waters, approximately 30,000 drums of waste, 220,000 gallons of hazardous waste from tanks and 5,650 yd^3 of contaminated soil and cooling pond sludge. A clay cover, placed over the site, was recently compacted.

REMEDIAL INVESTIGATIONS

SCOPE

Remedial investigations began in 1983 and continued until December 1984. Soil, hydrogeologic, and surface water and sediment investigations were conducted.

Two phases of soil sampling were conducted. Phase 1 consisted of 15 surficial soil samples and 15 shallow (2.5 foot depth) borings and was conducted before removal of 2 feet of contaminated surface soil from most of the site. Phase 2, conducted after soil removal, consisted of 9 soil borings (up to 12 feet in depth) through the concrete pad on the south 1/3 of the site and 12 test pits to depths up to 10 feet in the remaining areas.

Hydrogeologic investigations included an electrical resistivity survey, test drilling, monitoring well installation, monitoring well sampling and residential well sampling. A total of 16 2-inch diameter PVC monitoring wells were installed in 3 phases. Wells were placed to monitor the shallow saturated zone, the shallow sand and gravel aquifer and the deep confined aquifer. Groundwater sampling was also performed in 3 phases. In addition, 5 residential wells were also sampled.

Surface water investigations included three onsite and four offsite surface water samples and 6 offsite sediment samples.

RESULTS

Onsite soil sample inorganic analysis results showed only antimony, cadmium, cobalt, copper, lead, manganese, and zinc were at concentrations exceeding the typical range in soil. Of these, cadmium, lead, and zinc were reported in more than one sample at concentrations exceeding the typical range in soils. Exceedance of the typical ranges in soil samples of inorganic constituents beneath the concrete pad is relatively minor relative to the soil contamination in the northern drum and tank storage areas. Inorganic contamination of the soil is apparently greatest in the near surface (0-3 feet) soil in northern portions of the site. Inorganic contamination does appear to extend to depths of at least 5 feet in the northern portions of the site, although it is less widespread than observed in the overlying shallow soil.

Primary organic contaminants found in site soils are volatile organic compounds and phthalates. These compound groups are the most widespread organic contaminants and are generally present in the highest concentrations. Total volatile organic contaminants (VOC's) ranged from 16 to 14,604,000 ug/kg. Total phthalates ranged from "not detected" to 370,000 ug/kg. Organic contamination decreases in the variety of compounds and their associated concentrations with depth. However, organic contaminants were detected to the maximum depth of sample analysis (8.5 feet).

Results of the hydrogeologic investigations indicate the existence of 4 hydrogeologic units in the area, a shallow saturated zone, a shallow sand and gravel aquifer, a silty clay and clayey silt zone and a deep confined aquifer.

Migration of soil contaminants to the shallow saturated zone has occurred onsite as evidenced by high levels of organic contaminants in one well onsite. The shallow sand and gravel aquifer has been shown to be contaminated with inorganics and organics in one well offsite and lesser amounts of organics in one well onsite and another immediately adjacent and downgradient of the site. Because of the presence of the NSL east of ECC, it cannot be definitively stated that the source of offsite contamination is ECC though the contaminants are consistent with those found onsite. Organic contamination in the other two wells is likely due to onsite soils at ECC since they are directly downgradient of ECC contaminated soils and not NSL.

Contamination of the shallow sand and gravel aquifer may have occurred either via migration through the silty clay till onsite or through contaminated water and sediment in the former cooling water pond, since it intersected the shallow sand and gravel aquifer before its removal and backfilling.

The deep confined aquifer below the site has not been found to be contaminated. Future migration of onsite contaminants to the deep aquifer is highly unlikely due to an upward vertical hydraulic gradient.

Migration of contaminants to the nearest residential wells surrounding the site is not indicated by the results of the residential well sampling.

Surface water sampling results indicate that inorganic contamination of surface water does not appear to be occurring offsite in the vicinity of ECC. Inorganic sediment contamination in the vicinity of ECC is limited to lead in the unnamed ditch. Organic contamination of offsite surface water was found in Finley Creek near Highway 421. Contaminants consist almost entirely of chlorinated hydrocarbons and are consistent with contaminants found in ECC soils. Also, surface water ponded on the clay cap onsite was found to be contaminated with a variety of base/neutrals and volatile compounds.

Two organic compounds possibly resulting from the ECC site were found in sediments in the unnamed ditch and and in Finley Creek near Highway 421.

CONTAMINANT TRANSPORT AND FATE

Analytical results of the remedial investigations characterize current site contamination. Future conditions assuming no action is taken at the site were estimated based on potential transport pathways and the natural attenuation and degradation of contaminants. Due to the large numbers of site contaminants, 14 indicator chemicals from four major contaminant groups were used in the estimation of transport and fate. Transport and fate are briefly summarized here for volatile organic contaminants, phenols, phthalates, and polychlorinated biphenyl's (PCB's). Transport of inorganic constituents from the soil is considered negligible due to the low levels found and the adsorptive capacity of the on-site soils.

Transport and fate of the indicator chemicals are based on a literature review and site characteristics. Due to the relatively limited literature available and the many estimates and assumptions necessary, the transport and fate calculated here are gross best estimates only. Actual transport and fate may vary by orders-of-magnitude.

Degradation of volatiles in soil is highly variable. If leaching is prevented, most of the indicator volatiles will degrade to 10^{-6} cancer risk levels relatively rapidly (possibly within 10 years). Several of the indicator volatiles will take much longer to degrade to 10^{-6} cancer risk levels. Degradation products, however, may pose new risks. Phenols and phthalates in the subsurface soil are already below 10^{-6} cancer risk levels. PCB's will tend to persist in the soil at the site.

Under existing site conditions, the volatiles, phenols, and certain phthalates will tend to leach from subsurface soil into the groundwater and slowly migrate to the unnamed ditch or Finley Creek (PCB's and most phthalates will only leach in trace amounts). Estimates for travel time vary from 10 years to 4,000 years depending upon the compound, hydraulic conductivity, and travel distance. Once in the surface waters, contaminants will either volatilize, adsorb to sediments, or experience large dilutions before reaching the Eagle Creek Reservoir.

ENDANGERMENT ASSESSMENT

The endangerment assessment found that under the no action alternative potential risk to human health and the environment exist at the ECC site. The affected media are soil, groundwater and surface water. They were assessed based on comparison of concentrations at exposure points to lifetime excess cancer risks, acceptable daily intake values, and relevant or applicable standards, criteria or guidelines. For the public health concerns residential and occupational use settings were used in assessing risk. An excess lifetime cancer risk of $1x10^{-6}$ is often used to reflect a level of concern for carcinogen risk.

For public health concerns, the exposure routes that resulted in an excess lifetime cancer risk greater than $1x10^{-6}$ are listed below:

- o Soil via ingestion: the south concrete pad soil at intermediate depth in a residential setting; and north test pit area at shallow and intermediate depth in residential and occupational use settings.

- o Groundwater via ingestion: the shallow saturated zone and shallow sand and gravel aquifer at current concentrations in both use settings; the shallow saturated zone at future projected concentrations in both use settings.

- o Groundwater via dermal absorption of volatile organic compounds: during bathing, the shallow saturated zone and shallow sand and gravel aquifer at current conditions in the residential setting; the shallow saturated zone at future projected concentrations in the residential setting.

- o Ingestion of fish that bioconcentrated contaminants from the surface water: Finley Creek under the lowest dilution situation at projected concentrations.

Risk from dermal absorption of volatile compounds via wading in the surface water does not exceed 1×10^{-6}. However, wading in the unnamed ditch and in Finley Creek under the lowest dilution situation has excess lifetime cancer risks between 1×10^{-6} and 1×10^{-7}. Given the uncertainty in both risk estimation and fate, and transport calculations, it is possible for the risk to be orders-of-magnitude higher or lower than estimated.

For environmental concerns the projected release of contaminants to the surface water in the unnamed ditch should not exceed the ambient water quality criteria for protection of aquatic life and other known LC_{50} values.

The risk analysis performed for the endangerment assessment is conservative and tends to reflect upper bound exposures. However, given the uncertainty in both risk estimation and fate and transport calculations, the actual risks may be lower or higher than estimated.

The current impact of the site is limited due to the low population at risk. Site location and environmental media characteristics (for example, low groundwater flow velocity) limit the population at risk if there is future development of the site and the surrounding area under the no action alternative. The environmental impacts also would be similarly restricted.

In conclusion, the ECC site poses a threat to the public health, welfare, and environment and a feasibility study of remedial actions to cost-effectively mitigate the site hazards should be performed.

GLT424/52

Chapter 2
INTRODUCTION

This remedial investigation (RI) report for the Environmental Chemical and Conservation Corporation (ECC) site near Zionsville, Indiana, is prepared in partial satisfaction of Contract No. 68-01-6692, Work Assignment No. 18.5L30.0, and the Final Work Plan (April 1983), Tasks 1 through 5.

PURPOSE OF THE REPORT

This RI report is based, in part, on data obtained during remedial investigation activities conducted from April 1983 through December 1984 at the ECC site. These data and those from other sources are used to define the site problems, identify pathways and receptors, and determine the necessity for and extent of remedial actions at the site.

The purpose of this RI report is threefold: 1) document the details of remedial investigation activities through technical memorandums included in Appendix A, 2) summarize and present the site investigation analyses and conclusions, and 3) determine if there is a threat to public health, welfare or the environment.

ORGANIZATION OF THE REPORT

This RI report is organized into four main sections. Chapter 3 presents a description of the site and its history. Chapter 4 presents the summary and results of the RI. Chapter 5 presents contaminant transport and fate. Chapter 6 presents the methodology and results of the endangerment assessment. Volume 2 of the RI Report presents the appendixes that contain detailed documentation of activities and specific data obtained for each task completed during the RI.

RI ACTIVITY TECHNICAL MEMORANDUMS

Each RI activity is described in a technical memorandum (TM) issued during the course of RI work. These TM's are contained in Appendix A of this report. Each TM describes specific procedures, observations, measurements, and data results of RI activities.

ANALYSIS OF SITE INVESTIGATIONS

The results of site investigations conducted at ECC from April 1983 through December 1984 are organized by the operable units. The analysis provides the technical basis for identification of problems and pathways of contamination for each operable unit.

CONTAMINANT TRANSPORT AND FATE

The pathways of contamination are identified and estimated ranges of transport rates and fates of contaminants are presented. The results form the basis of the assessment of the no action alternative.

ENDANGERMENT ASSESSMENT

The results of the site investigations and the contaminant transport and fate analysis are used in the endangerment assessment to determine if a threat to human health or the environment exists at the site. The endangerment assessment will in turn be used in deciding if a feasibility study is necessary at the site and, if so, what the remedial action objectives will be.

GLT424/114

Chapter 3
SITE BACKGROUND

SITE DESCRIPTION

ECC is in Boone County, 865 south U.S. 421, Zionsville, Indiana, about 10 miles northwest of Indianapolis (Figure 3-1). The site occupies 6.5 acres alongside the 168 acre Northside Sanitary Landfill (NSL), an ongoing solid waste disposal facility (Figure 3-2).

The ECC facility is bounded on the east by the landfill. A site map showing the site as it was in 1982 is shown in Figure 3-3. An unnamed ditch separates the two facilities along the east boundary. The site is bounded on the north and west sides by several residential homes, all located within one-half mile of the facility.

SITE HISTORY

ECC began operation in August of 1977 under a construction permit issued by the Indiana Air Pollution Control Department (APCD) on May 5, 1977. The company was engaged in the recovery/reclamation/brokering of primary solvents, oils and other wastes received from industrial clients. Waste products were received in drums and bulk tankers and prepared for subsequent reclamation or disposal. Reclamation processes included distillation, evaporation and fractionation to reclaim solvents and oil.

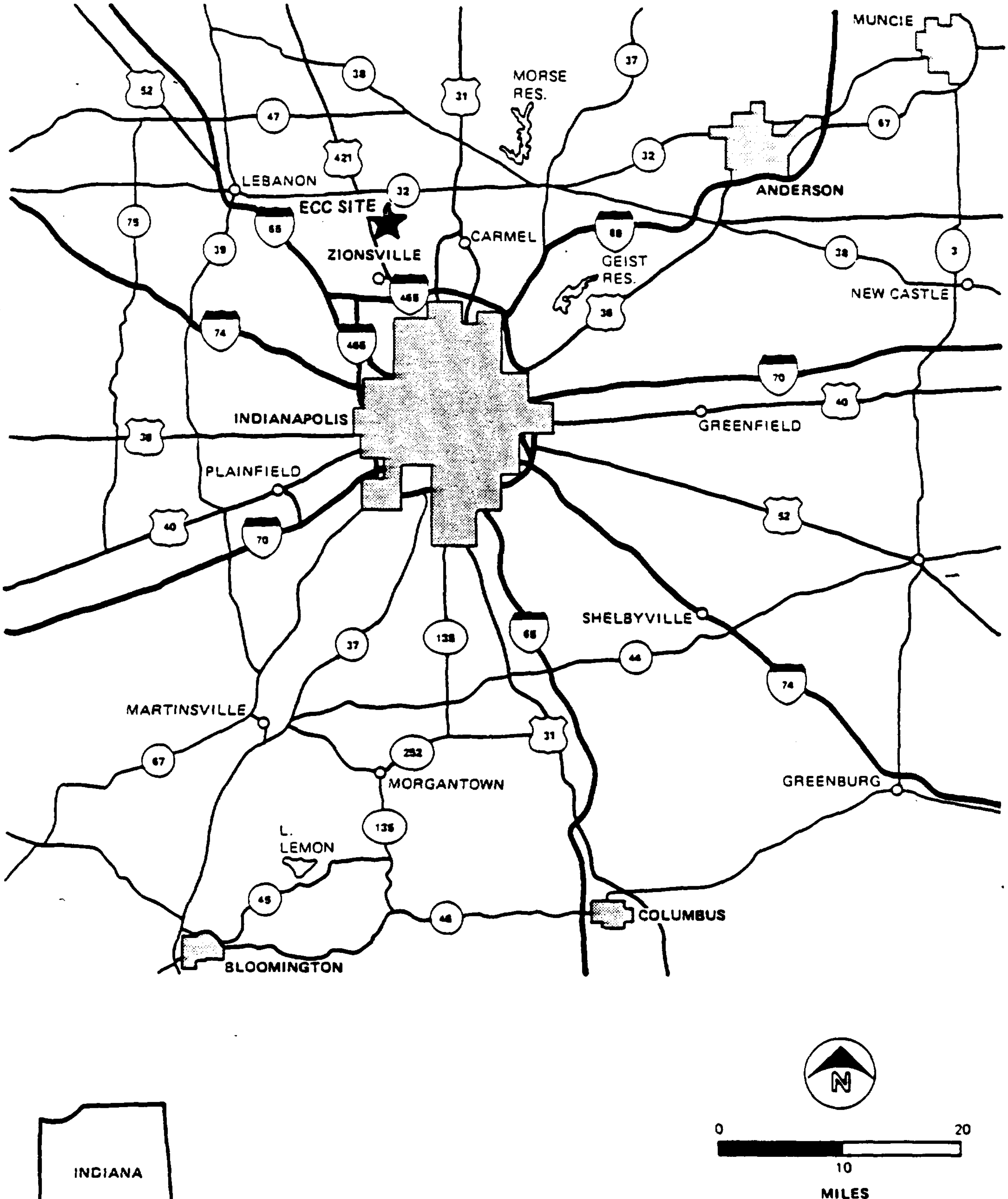
Two problems developed during the facility's operation:

- The inability of the company to adequately dispose of wastewater and contaminated stormwater generated at the facility,

- The inability of the company to manage its drum inventory in a manner that did not pose a threat to the environment.

In an attempt to handle the wastes generated onsite, approval was sought by ECC to dispose of 5,000 gallons per day of oil recovery wastes and 1,000 to 1,500 gallons per week of still bottoms at NSL. Approval to dispose of the still bottoms was granted (with conditions) by the SPCB on October 11, 1977; however, the request to dispose of the liquid waste from the oil recovery operations was denied.

Subsequently, the company sought other avenues of waste disposal. An agreement was reached between the Indiana State Board of Health (ISBH), ECC, and NSL to allow disposal of oily wastes in the landfill with municipal refuse.



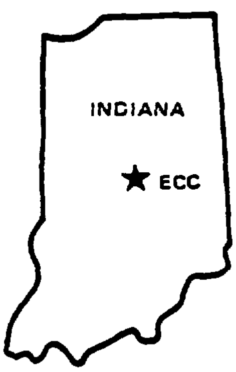


FIGURE 3-1
LOCATION MAP
ECC RI REPORT

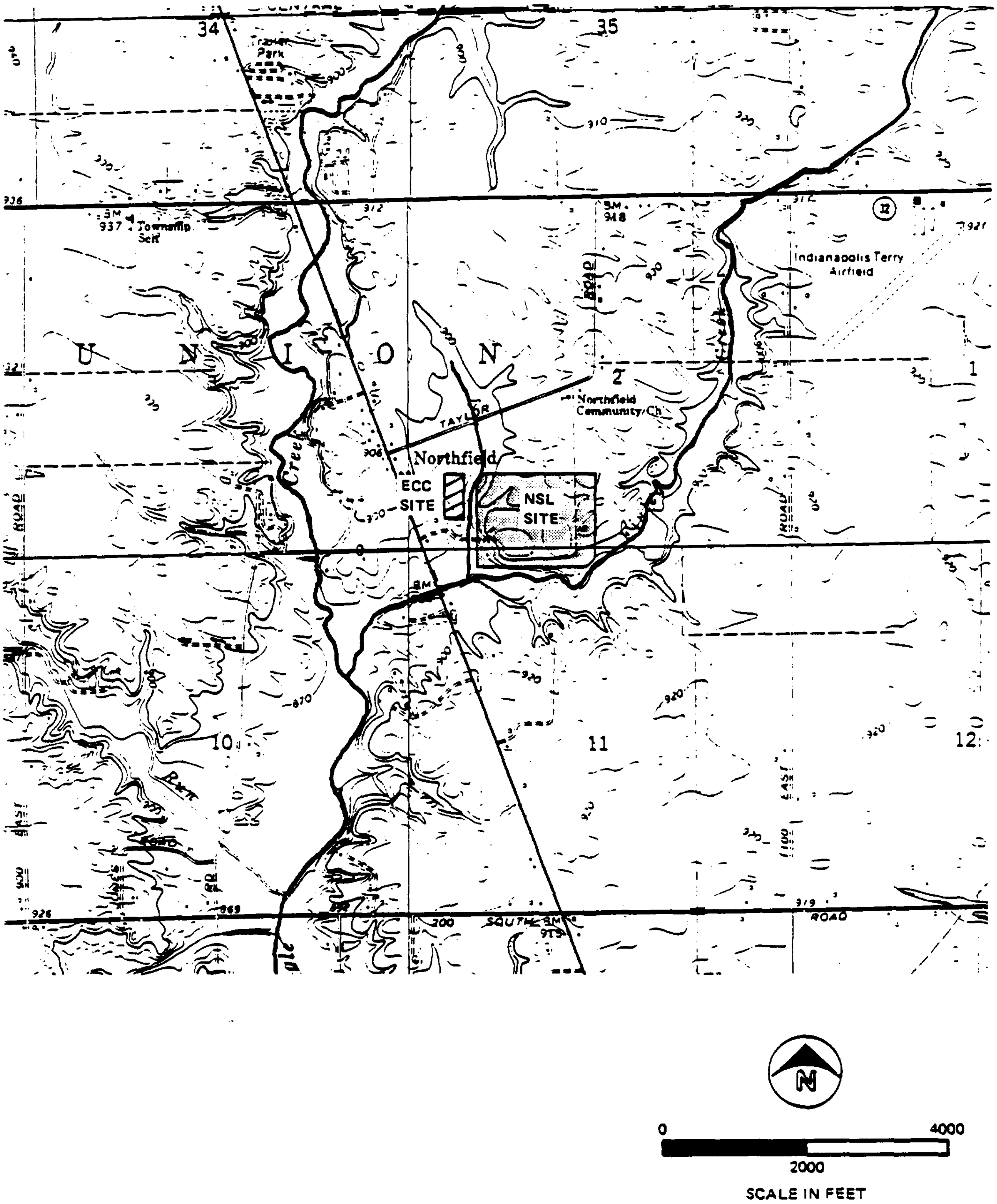


FIGURE 3-2
VICINITY MAP
ECC RI REPORT

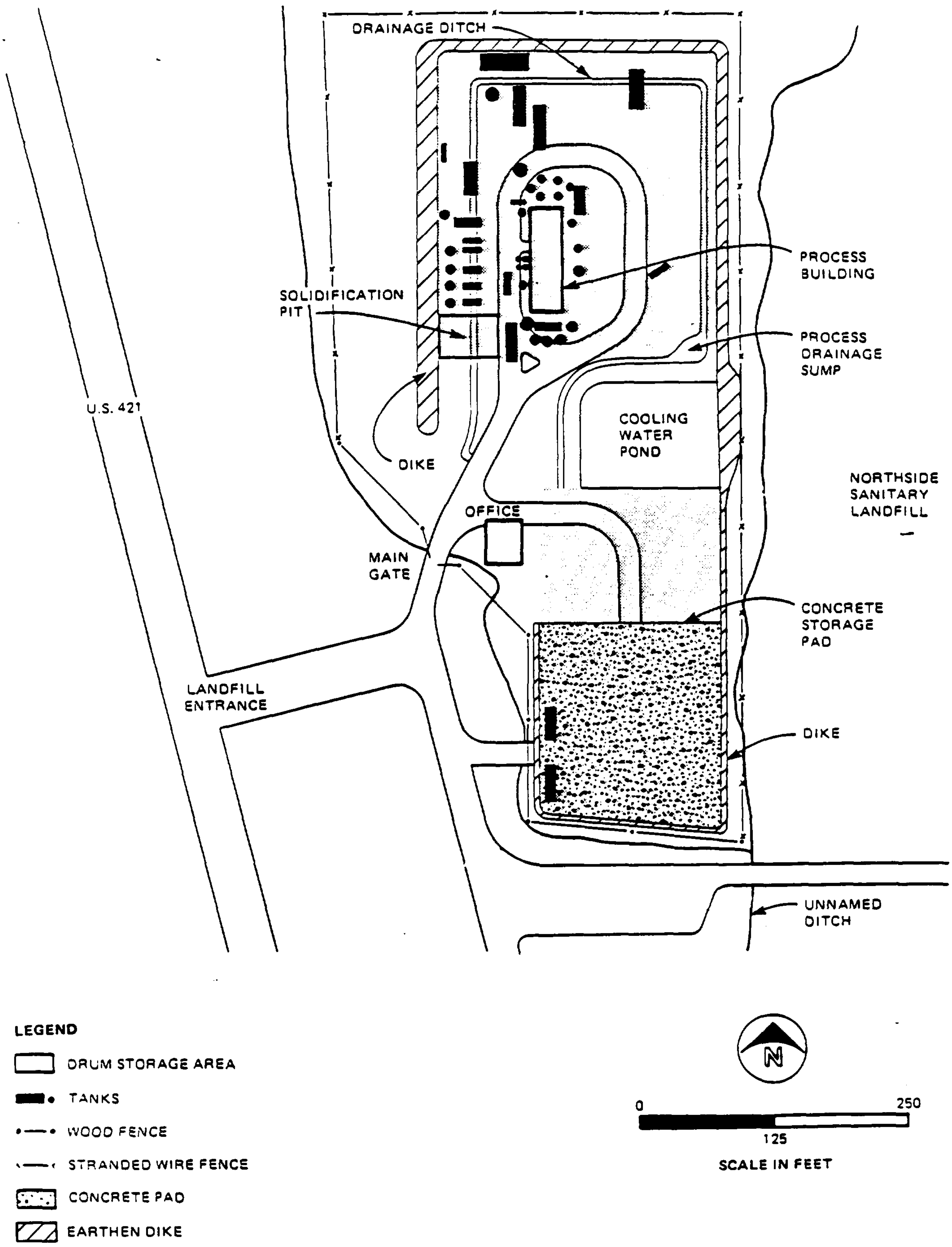


FIGURE 3-3
SITE MAP (1982)
ECC RI REPORT

Following expiration of this agreement in May 1979, ECC added units to process wastewater by distillation onsite. The product water was used as boiler makeup water.

On July 31, 1979, the ISBH received a report from a private citizen that an oil spill had occurred on Eagle Creek north of Zionsville. Immediate inspection revealed that the oil had originated from ECC and a minor amount from NSL. ECC agreed to take action to recover the oil. A followup investigation conducted on August 2, 1979 by the ISBH showed that ECC intentionally discharged process and cooling water from a storage lagoon into Finley Creek without a permit. ECC officials explained that due to heavy rains, stormwater pumped from the drum storage and loading areas to the cooling water pond caused it to overflow. Therefore, it became necessary to drain the excess water.

On September 18, 1979, the SPCB met to discuss the spill and discharge incidents at ECC. The board ratified an Agreed Order that included a fine and provisions to upgrade the methods of recordkeeping at the facility. In November 1979, the SPCB began a water sampling and analysis program at the site. Cooling water pond samples taken on November 2, 1979 were found to contain high concentrations of arsenic, cadmium, chromium, lead, nickel, oil and grease, phenol, and zinc. Further testing of area wells and streams were inconclusive in documenting contamination of groundwater and surface water.

In December 1979, the U.S. EPA designated ECC as a potential hazardous waste site and began investigations under the Hazardous Materials Emergency Response Program. By April 17, 1980, the ISBH submitted documentation to the Indiana Environmental Management Board (EMB) concerning ECC violations of the Environmental Management Act, the Air Pollution Control Law and the Stream Pollution Control Law. Specifically, the staff documented that:

- ECC posed a threat to pollute the environment.
- The company was burning chlorinated hydrocarbons and other solvents as boiler fuel without approval.
- Process water and contaminated stormwater were discharged without approval.
- Spills of oil and other objectionable substances occurred and were not reported or effectively cleaned up.

Based on these violations, the EMB referred the matter to the Office of the Attorney General on May 15, 1980 for appropriate enforcement.

On February 9, 1981, an ECC employee died of exposure to toxic vapors after entering a solvent tanker.

A Consent Decree was issued on July 1, 1981, by the Boone County Circuit Court imposing a $50,000 civil penalty against ECC. Furthermore, the court placed ECC into receivership and prohibited the company from using NSL for disposal of wastes. The decree gave ECC until November 1, 1982 to comply with environmental laws and regulations.

At this point, the ISBH began weekly monitoring of ECC's drum storage area to insure that action was being taken to reduce barrel inventory and improve storage facilities. The area was found to be extremely overcrowded with drums, some of which were damaged and leaking. Access was also dangerously poor. By October of 1981, construction of a concrete drum storage pad was underway and drum inventory had been reduced to an estimated 20,000 barrels. By December, the number of leaking, formerly leaking, popped top, corroded/damaged, and bungless/open top drums had been reduced to about 225. In February 1982, the EMB placed a freeze on drum shipments to the facility before the Boone County Circuit Court to assure compliance with the Consent Decree regarding storage of drums, location of materials onsite and in transit, and the removal of sludge.

On May 5, 1982, ECC was ordered by the court to close and environmentally secure the site for failure to reduce hazardous waste inventories. Two days later ECC's court receiver filed a closure plan with the Boone County Circuit Court. By August 1982, ECC was found to be insolvent and planning work had begun for environmental revitalization, cleanup, and recycling of the site.

On September 21, 1982, the Office of the Attorney General held a conference with the ISBH and representatives from 60 generators of waste to propose a voluntary cleanup plan for the ECC site. The closure plan and settlement offer required generators to remove and dispose of wastes and pay $250/drum into a trust fund to be used for remaining surface/subsurface remedial measures. In return, generators would receive a limited release. In response to the offer, the generators entered into a loose coalition and hired Chemical Waste Management, Inc., to prepare a technical proposal for a complete surface cleanup. Initial negotiations between U.S. EPA and the generators for site surface cleanup were not successful.

PREVIOUS INVESTIGATIONS

Sampling and testing efforts were conducted at ECC from 1976 through 1982. Sources of data were primarily laboratory data sheets or handwritten data summary tables, generally unaccompanied by descriptions of the sampling and testing procedures used. As such, much of this historical data summarized herein could not be used as a basis for definitive interpretations of existing conditions onsite or offsite at ECC. Rather, the data could be used in qualitative assessments of contamination and in determining locations where further testing would be needed.

Historical sampling and testing information for ECC is discussed under the following headings:

- Onsite surface water and sediment
- Offsite surface water and sediment
- Groundwater
- Residential well water
- Soil
- Aquatic biota

ONSITE SURFACE WATER AND SEDIMENT

Sampling and Testing

Table 3-1 summarizes the known surface water and sediment sampling events that took place onsite at ECC before RI activities began. Three general locations have been sampled: the cooling water pond, the north drum storage area pond, and the south drum storage area pond.

Sampling and testing procedures were not available for any of the events listed. However, all EPA samples were analyzed by labs selected and certified as part of the Contract Laboratory Program (CLP). Standard procedures are utilized by these labs for the analysis of organic and inorganic priority pollutants.

All of the ISBH samples were analyzed by the ISBH Water Laboratory. The lab analyzed blanks and surrogate spikes with each set of samples. Duplicates were only occasionally analyzed.

Results

Analytical results are summarized in Tables 3-2 and 3-3. Table 3-2 presents the data for samples upon which only a limited analysis was performed. Table 3-3 summarizes the data for samples exposed to a more extensive analytical testing program.

The following inorganic chemicals were detected in the cooling water pond water samples at levels above EPA Water quality criteria:

Table 3-1
HISTORICAL ONSITE SURFACE WATER AND SEDIMENT SAMPLING
ECC SITE

Sampler	Sampling Date	Analytical Laboratory	Document Number	Sampling Location	No. of Samples Water	Sediment	Parameters Analyzed	Data Summary
ISBH	3/2/79	Water Laboratory, ISBH	24	Cooling water pond	1		COD, Pb, Hg, oil, phenol	Table 3-2
ISBH	6/8/79	Water Laboratory, ISBH	23	Cooling water pond; south storage area	2		As, Cd, Cr, Pb, Hg, Ni, Zn, oil, phenol, Cn	Table 3-2
ISBH	8/2/79	Water Laboratory, ISBH	33	Cooling water pond; south storage area	1		Oil, BOD, COD, Pb, Ni, Zn	Table 3-2
ISBH	11/2/79	Water Laboratory, ISBH	35	Cooling water pond; north and south storage areas	5		As, Cd, Cr, Pb, Hg, Ni, Zn, oil, phenol, pH	Table 3-2
ISBH	4/3/80	Water Laboratory, ISBH & Industrial Hygiene Laboratory	45	South storage area	1		PCB, Cd, Cr, Ni, Pb, Zn, Cu, phenol	Table 3-2
EPA	4/10/80	CLP[a]; W. Coast Technical Service, Inc.	47	Cooling water pond; south storage area	2		Organic priority pollutants	Table 3-3
ISBH	4/17/80	Water Laboratory, ISBH	48	North and south storage areas	2		As, Cd, Cr, COD, Cu, Pb, Ni, pH, phenol, Zn	Table 3-2
ISBH	3/10/81	Water Laboratory, ISBH	113	Cooling water pond	1	1	Metals, PCB's, volatile organics, others	Table 3-3
ISBH	4/29/81	Water Laboratory, ISBH	104	South storage area	2		Phenol, TOC, oil, volatile organics	Table 3-2
EPA	8/9/82	CLP	181	Cooling water pond	1		Organic priority pollutants	Table 3-3
EPA	10/18/82	CLP	209	Cooling water pond; north and south storage areas	4	1	Organic and inorganic priority pollutants	Table 3-3

[a] CLP = Contract Laboratory Program

GLT424/24

Table 3-2
HISTORICAL ONSITE SURFACE WATER
SAMPLING RESULTS (ug/L)
ECC SITE

Water Quality	Cooling Water Pond				South Drum Storage Area Pond						North Drum Storage Area Pond			EPA Water Quality
Parameter	03/02/79	06/08/79	08/02/79	11/02/79	06/08/79	11/02/79	11/02/79	04/03/80	04/17/80	04/29/81	11/02/79	11/02/79[f]	04/17/80	Criteria[a]
Arsenic		4		11	1	6	4		18		60	900	7	0.022[c,d]
Cadmium		< 20		< 10	< 10	40	160	70	38		10	300	17	10[b]
Chromium		390		< 10	1,100	40	250	770	380		1.6	104,000	1,000	50[b,e]
Lead	31,000	520	80	< 20	80	90	80	110	40		0.3	66,000	310	50[b]
Mercury	< 10,000			< 0.5		< 0.5	< 0.5				0.9	< 200		0.144[b]
Nickel		230	70	40	40	50	120	160	140		90	500	30	13.4[b]
Zinc		580	290	150	2,300	140	260	290	90		1,090	18,000	3,100	NCA
Copper								460	838				11,100	NCA
Phenol	8,800			65,300	28,000	22,500	25,500	22,400	13,000	10,000	35	3,000,000	8,900	3,500[b]
Oil	80,000,000	18,000,000	8,300	20,000	110,000	180,000	63,000			62,400	3,032,000			--
pH				6.3	2.0	7.3	7.2		6.9		7.1		7.1	--
BOD			1,800,000											--
COD	26,000,000								5,700,000				430,000,000	--
TOC			6,000,000							910,000				--
PCB								3.5						0.00079[c]

NCA = Insufficient data available upon which to derive a criterion.
Blank indicates parameter not analyzed.
[a] For the protection of human health assuming a daily ingestion of 2 liters of water.
[b] Toxicity criteria.
[c] Carcinogenicity criteria at the 10^{-5} risk level.
[d] Criteria applies to total trivalent arsenic.
[e] Criteria applies to total hexavalent chromium.
[f] Oil layer.

GLT424/26

Table 3-3
HISTORICAL ONSITE SURFACE WATER AND SEDIMENT
SAMPLING RESULTS (ug/L)
ECC SITE

Organic Priority Pollutants	Cooling Water Pond 04/10/80	Cooling Water Pond 03/10/81	Cooling Water Pond 08/09/82	Cooling Water Pond 10/18/82	Cooling Water Pond Sediment 03/10/81	South Drum Storage Area Ponds 04/10/80	South Drum Storage Area Ponds 04/29/81[f]	South Drum Storage Area Ponds 10/18/82	North Drum Storage Area Pond 10/18/82	EPA Water Quality Criteria[a]
1,1,-Dichloroethane	ND	4.4	17	ND	70	ND	< 5	ND	ND	NCA
1,1,1-Trichloroethane	6,821	< 900	831	1,322	730	ND	160	621	1,266	18,400[b]
1,1,2-Trichloroethane	16		< 2.8			ND	< 5			6.0[c]
1,1-Dichloroethene	152	< 300	95	ND		ND	< 5	ND	ND	0.33[c]
1,2-Dichloroethene	259	< 50	2,022	2,848	230	48		1,541	2,766	NCA
Tetrachloroethene	1,297	190	12	0.6	< 100	ND	260	1,176	71	8[c]
Trichloroethene	3,873	< 600	191	673	470	ND	320	1,176	1,398	27[c]
Methylene Chloride	5,470	240	1,329	3,908	1,500	485	180	3,873	5,548	1.9[c]
Chloroform	ND	59	21	ND	90	< 10	9.1	ND	ND	1.9[c]
Trichlorofluoromethane	ND		< 2.7			14	< 5			1.9[c]
Toluene	2,700	4,100			630	935	600,000			14,300[b]
Nitrophenol	270		< 59			ND				NCA
Pentachlorophenol	38		< 170			103		5	ND	1,010[b]
Phenol	1,930	1,200	15,000	396	< 200	ND		460	325	3,500[b]
2,4-Dimethylphenol	ND		260	251		349		236	121	NCA
2,4,6-Trichlorophenol	ND		< 62	5		ND		4	3	12[c]
Benzene	ND	< 300	< 0.5	ND	90	ND	< 8	ND	463	6.6[c]
Methylbenzene	ND		858	974		ND		1,035	1,132	--
Ethylbenzene	ND	600	110	ND	330	1,188	310	ND	ND	1,400[b]
1,3-Dimethylbenzene	ND		98	ND		ND		ND	ND	--
1,2 & 1,4-Dimethylbenzene	ND		79	ND		ND		ND	ND	--
1,3-Dichlorobenzene	ND		< 25	0.5		ND		17	92	400[b]
1,4-Dichlorobenzene	ND		< 22	0.4		ND		15	86	400[b]
1,2-Dichlorobenzene	ND		< 25	0.5		27		18	97	400[b]
Diethylphthlate	27		86	47		433		32	ND	350,000[b]
Dimethylphthlate	311		240	175		513		169	164	313,000[b]
Butylbenzylphthalate	ND		< 290	1,122		ND		3,277	2,457	NCA
Di-n-butylphthalate	< 10		76	29		< 10		87	135	34,000[b]
Napthalene	ND		< 23	12		ND		16	29	NCA
Isophorone	ND		3,200	ND		ND		ND	ND	5,200[b]
P-Chloro-M-Cresol	ND				2,600	91				NCA
PCB's		< 50								0.00079[c]

GLT424/25-1

Table 3-3 (Continued)

Organic Priority Pollutants	Cooling Water Pond 04/10/80	03/10/81	08/09/82	10/18/82	Sediment 03/10/81	South Drum Storage Area Ponds 04/10/80	04/29/81[f]	10/18/82	North Drum Storage Area Pond 10/18/82	EPA Water Quality Criteria[a]
Arsenic		4.7		6.0	10,000			5.9	5.7	0.022[c,d]
Cadmium		12		3.07				5.59	9.81	10[b]
Chromium		150		286	19,000			326	320	50[b,e]
Lead		120		< 70	14,000			96.0	179	50[b]
Mercury		0.2		< 0.1	30					0.144[b]
Nickel		30		184	18,000			201	169	13.4[b]
Zinc		390		397	54,000			956	1,510	NCA
Copper		300		29.8	26,000			72.3	124	NCA
Aluminum		900		1,190	10,000,000			2,770	3,030	--
Barium				138				172	183	--
Beryllium		< 10		< 1	700			< 1	< 1	0.068[c]
Cobalt				13.6				25.7	34.3	--
Iron				6,840				14,600	19,800	--
Manganese				2,370				2,370	1,960	--
Boron				712				684	389	--
Vanadium				8.6				13.3	12.6	--
Silver				< 3				< 3	< 3	50[b]
Antimony				2.2				< 2	< 2	146
Thallium				< 2				< 2	< 2	13[b]
Tin				< 40				< 40	62.6	--
Ammonia		200		5,290	< 100					--
Cyanide		52		16	< 625					200[b]

ND = Not Dectected.
NCA = Insufficient data available upon which to derive a criterion.
Blank indicates parameter not analyzed.
- Indicates no criteria is available.
[a] For the protection of human health assuming a daily ingestion of 2 liters of water.

[b] Toxicity criteria.
[c] Carcinogenicity criteria at the 10^{-5} risk level.
[d] Criteria applies to total trivalent arsenic.
[e] Criteria applies to toal hexavalent chromium.
[f] Oil layer.

- o Cadmium
- o Lead
- o Mercury
- o Nickel

A sample of the surficial oil layer from the north storage area pond taken on November 2, 1979, was found to contain arsenic, cadmium, chromium, lead, nickel, and zinc far in excess of the levels found for the pond water samples.

Listed in Table 3-3 are the organic priority pollutants found in at least one of the pond water samples above the detection limits. Background levels for these compounds are generally < 1 ug/l. The following eleven substances were found in the pond water samples at levels above EPA water quality criteria:

- o 1,1,2-Trichloroethane
- o 1,1-Dichloroethene
- o Tetrachloroethene
- o Trichloroethene
- o Methylene chloride
- o Chloroform
- o Trichlorofluoromethane
- o Toluene
- o Phenol
- o Benzene
- o PCB's

Each of the onsite surface water areas sampled were found to contain levels of organic priority pollutants exceeding EPA water quality criteria.

One sample of the cooling water pond sediment was tested by the EPA. Inorganic pollutants reported in levels above background levels in sediment were arsenic, aluminum, chromium, nickel and copper. Organic pollutants reported in levels above background were 1,1-dichloroethane, 1,1,1-trichloroethane, 1,1-dichloroethene, trichloroethene, tetrachloroethene, methylene chloride, chloroform, toluene, benzene, ethylbenzene and PCB's.

OFFSITE SURFACE WATER AND SEDIMENT

Sampling and Testing

Table 3-4 summarizes offsite surface water and sediment sampling episodes at ECC. The majority of sampling has been performed by the ISBH. The U.S. EPA performed one sampling episode. The United States Geologic Survey (USGS) performed three sampling episodes, collecting a total of 7 water samples and 15 sediment samples.

Table 3-4
HISTORICAL OFFSITE SURFACE WATER AND SEDIMENT SAMPLING
ECC SITE

Sampler	Sampling Date	Analytical Laboratory	Document Number	Sampling Location[a]	No. of Samples Water	No. of Samples Sediment	Chemicals Analyzed	Data Summary
John Bankert	9/15/76	O.A. Laboratories	19	Creek[b]	1		pH, COD, Fe, Cr, Ni, Pb, Zn, Cd, Cl⁻	None
ISBH	6/8/79	Water Laboratory, ISBH	23	E	3		As, Cd, Cr, Pb, Hg, Ni, oil, pH, phenol, Zn, PCB	Table 3-5
ISBH	7/31/79	Water Laboratory, ISBH	33	Finley Cr, Unnamed Ditch, Eagle Creek	5		Oil	None
ISBH	8/2/79	Water Laboratory, ISBH	33	E, F	2		Oil, BOD, COD, Pb, Ni, Zn	Table 3-5
ISBH	11/2/79	Water Laboratory, ISBH	35	E, K	2		As, Cd, Cr, Pb, Hg, Ni, oil, pH, phenol, Zn	Table 3-5
EPA	4/10/80	CLP - W. Coast Technical Services, Inc.	47	E, J, K	3		Organic priority pollutants	Table 3-6
ISBH	4/17/80	Water Laboratory, ISBH	48	C, G, H, K	4		As, Cd, Cr, Cu, Pb, Ni, Zn, COD, pH, phenol	Table 3-5
ISBH	8/25/80	Water Laboratory, ISBH	65A	A, B, L, M	4		PCB, As, Cu, Pb, Zn, diazinon	Table 3-5
USGS	8/25/80	USGS Laboratory	240	A, C, O, P		11	Metals, pesticides, PCB, others	Table 3-7
ISBH	3/10/81	Water Laboratory, ISBH	113	A, C, E, N, P, Q, R	13	14	Metals, pesticides, PCB, volatile organics, others	Tables 3-6&7
ISBH	9/4/81	Water Laboratory, ISBH	137	B, E, H, I	4		Oil	None
ISBH	10/30/81	Water Laboratory, ISBH	149	D	1		Organic priority pollutants	Table 3-6
USGS	10/26/82	USGS Laboratory	240	A, P, S	4	4	Organic and inorganic priority pollutants	Tables 3-6&7
USGS	12/14/82	USGS Laboratory	240	A, S	3		Organic and inorganic priority pollutants	Table 3-6

[a] See Figures 3 and 4 for sample locations.
[b] Sampling location unknown.

CLT424/27

Sampling and testing procedure documentation was not available for the ISBH or EPA data. Testing procedures are known only in the general sense described earlier. Sampling and testing procedures employed by the USGS along with complete analytical results are described in: "Water and Streambed Material Data, Eagle Creek Watershed, Indiana, August 1980 and October and December 1982," Open File Report 83-215.

Results

Analytical results for the offsite surface water samples are summarized in Tables 3-5 and 3-6. Figure 3-4 indicates sampling locations. Table 3-5 presents data for surface water samples where only a limited analysis was performed. Table 3-6 summarizes data for samples where more extensive analysis was performed. Data are presented for only those water quality parameters that had reported levels higher than upstream levels for at least one location.

Two inorganic chemicals were detected in offsite surface waters above EPA water quality criteria levels. Lead was found at sampling location B (downstream of the confluence of the unnamed ditch and Finley Creek) at 80 ug/l and at sample location Q (a small tributary to the unnamed ditch south of the landfill drive) at 250 ug/l. Nickel was reported at 20 ug/l at sample locations E (in the unnamed ditch alongside ECC) and K (upstream of ECC in the unnamed ditch).

These inorganic chemicals may be originating from ECC or NSL. Nearly all sample locations downstream of ECC and NSL showed at least one inorganic chemical at levels above the upstream values.

Eight organic priority pollutants were detected in surface water downstream of ECC at levels in excess of EPA water quality criteria. These pollutants, were:

- o 1,1-Dichloroethene
- o Methylene chloride
- o Trichloroethene
- o Tetrachloroethene
- o Chloroform
- o Bis (2-chloroethyl)ether
- o Phenol
- o PCB's

These were reported at sample locations A, B, C, D, and E (Figure 3-4).

Analytical results for surface water sediment samples are presented in Table 3-7. As with Table 3-6, this table only presents data for parameters that had at least one reported

Table 3-5
HISTORICAL OFFSITE SURFACE WATER
SAMPLING RESULTS (ug/L)
ECC SITE

Water Quality Parameter	SAMPLE LOCATIONS DOWNSTREAM OF ECC A									SAMPLE LOCATIONS UPSTREAM OF ECC				EPA Water Quality Criteria[a]
	A	B	C	E			F	G	H	K		L	M	
	08/25/80	08/25/80	04/17/80	06/08/79	08/02/79	11/02/79	08/02/79	04/17/80	04/17/80	11/02/79	04/17/80	08/25/80	08/25/80	
Arsenic	1	3	3	4		3		18	1	1	1	2	ND	0.022[c,d]
Cadmium			2	< 10		< 10		< 2	< 2		< 2			10[b]
Chromium	10	60	160	< 10		< 10		< 10	< 10	< 10	< 10	13	10	50[b,e]
Lead	50	80	20	< 20	< 20	20	< 20	< 20	< 20	< 20	< 20	30	20	50[b]
Mercury				< 0.1		< 0.1				< 0.1				0.144[b]
Nickel			10	20	< 20	20	< 20	10	< 10	20	< 10			13.4[b]
Zinc	76	79	80	20	< 20	< 20	< 20	10	< 10	20	< 10	70	148	NCA
Copper			65					6	4		< 4			NCA
Phenol			9,800	2,000		< 5		1,500	< 5	7	< 5			3,500[b]
Oil				3,400	< 1	2,800	< 1			42,000				--
pH			7.2	1.7		7.2		6.8	7.7	7.3	7.7			--
BOD					22,000		22,000							--
COD			1,500,000		46,000		40,000	1,600,000	17,000		9,000			--
PCB	120	10		< 0.1								10	1	0.00079[c]

ND = Not detected.
NCA = Insufficient data available upon which to derive a criterion.
Blank indicates parameter not analyzed.
[a] For the protection of human health assuming a daily ingestion of 2 liters of water.
[b] Toxicity criteria.
[c] Carcinogenicity criteria at the 10^{-5} risk level.
[d] Criteria applies to total trivalent arsenic.
[e] Criteria applies to total hexavalent chromium.

GLT424/28

Table 3-6
HISTORICAL OFFSITE SURFACE WATER SAMPLING RESULTS (ppb)
ECC SITE

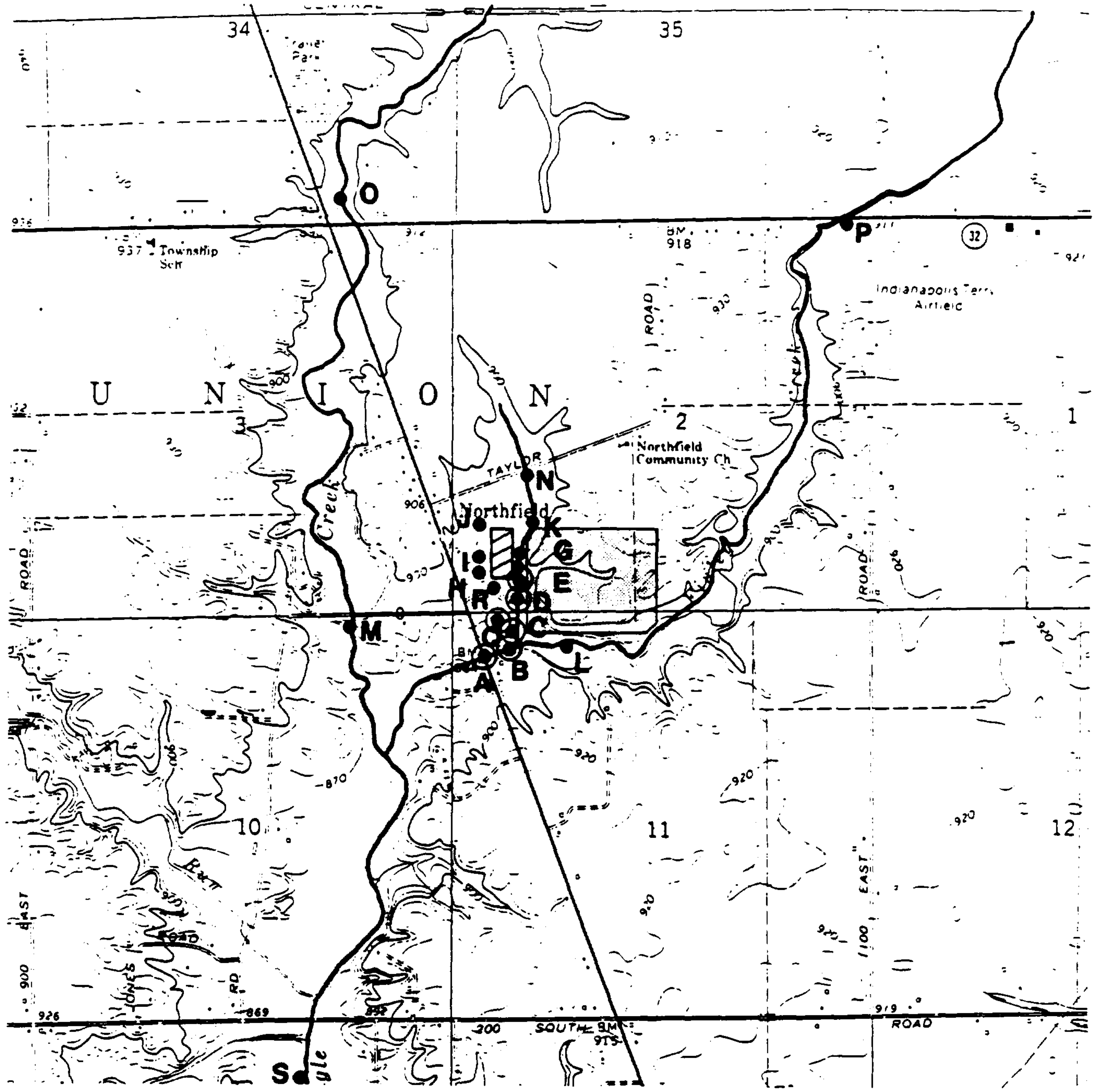
	SAMPLE LOCATIONS DOWNSTREAM OF ECC										
	S		A			C	D	E		R	Q
Water Quality Parameter[a]	10/26/82	12/14/82	03/10/81	10/26/82	12/14/82	03/10/81	10/30/81	04/10/80	03/10/81	03/10/81	03/10/81
Aluminum	480	100	100	300	100	100			200	100	12,000
Arsenic	4	2	0.7	6	3	1.1			0.8	0.6	4.0
Barium	200	200		400	100						
Copper	12	4	5	9	8	4			4	5	17
Iron	890	340		3,600	420						
Lead	6	3	< 10	5	5	10			10	20	250
Manganese	120	70		280	80						
Magnesium			116			116			100	112	924
Zinc	10	20	< 10	10	30	< 10			< 10	10	60
Strontium			170			170			150	120	650
COD			21			4			4	5	17
1,1 Dichloroethene	< 1	< 1	< 1	< 1	140	< 3	< 5	ND	< 1	< 6	< 1
1,1 Dichloroethane	< 1	< 1	1.9	220	< 1	26	6	ND	1.2	< 1	< 1
1,2 Trans-dichloroethene	< 1	< 1	< 20	1,000	9	< 20	< 5	45	< 1	< 20	< 20
Methylene Chloride	< 1	< 1	1.1	< 1	< 1	18	350	< 10	3.5	< 10	< 1
Trichloroethene	< 1	2	4.4	670	23	33	10	122	1	< 12	< 12
Tetrachloroethene	< 1	1	1.2	37	< 1	2	1.8	< 10	< 1	1.2	2
Toluene	< 1	2	< 3	7	2	5	< 6	< 10	< 3	< 3	< 3
1,1,1 Trichloroethane	< 1	< 1	5.9	510	< 1	30	570	ND	< 1	9.1	5.6
Chloroform	< 1	< 1		< 1	< 1		11.5	< 10			< 6
1,1,2 Trichloro-1,2,2-trifluoromethane	< 1	< 1	< 2	< 1	< 1	< 40	< 5	ND	< 10	54	< 2
Methyl ethyl ketone			< 52			270	1,900	ND	210	< 26	< 26
2,4 Dimethylphenol	< 1	< 1		12	< 1		< 10	ND			
Phenol	< 1	< 1	< 0.2	2,200	< 1	< 0.2	< 10	14	< 0.2	< 0.2	< 0.2
Butyl benzl phthalate	< 1	< 1		11	< 1		< 100	ND			
Bis (2-chloroethyl) ether	< 1	< 1		43	< 1		< 10	ND			
1-2 Dichlorobenzene	< 1	< 1		57	< 1		< 10	< 10			
Diethyl phthalate	< 1	< 1		6	< 1		< 20	ND			
Dimethyl phthalate	< 1	< 1		16	< 1		< 20	ND			
Di-n-butyl phthalate	< 1	< 1		27	< 1		< 30	< 10			
Bis (2-ethylhexyl)phthalate	< 1	< 1	< 0.35	13	< 1	< 0.35	< 100	ND	< 0.35	< 0.35	< 0.35
Isophorone	< 1	< 1		360	< 1			ND			
n-Nitrosodimethylamine	< 1	< 1		9	< 1		-	ND			

GLT424/30-1

Table 3-6 (continued)

Water Quality Parameter	SAMPLE LOCATIONS UPSTREAM OF ECC					EPA Water Quality Criteria[b]
	J	K	N	P		
	04/10/80	04/10/80	03/10/81	03/10/80	10/26/82	
Aluminum			100	100	80	--
Arsenic			0.2	0.7	3	0.022[d,e]
Barium					200	--
Copper			< 4	< 4	9	NCA
Iron					530	--
Lead			10	< 10	6	50[c]
Manganese					110	--
Magnesium			200	220		--
Zinc			< 10	< 10	10	NCA
Strontium			90	160		--
COD			6	8		--
1,1-Dichloroethene	ND	ND	< 1	< 1	< 1	0.33[d]
1,1-Dichloroethane	ND	ND	< 1	< 1	< 1	NCA
1,2-Trans-dichloroethene	ND	ND	< 1	< 1	< 1	NCA
Methylene Chloride	< 10	< 10	1.3	< 1	< 1	1.9[d]
Trichloroethene	ND	ND	< 1	< 1	< 1	27[d]
Tetrachloroethene	ND	ND	< 1	< 1	5	8[d]
Toluene	ND	ND	< 3	< 3	3	14,300[c]
1,1,1-Trichloroethane	ND	ND	< 1	< 1	< 1	18,400[c]
Chloroform	< 10	< 10			< 1	1.9[d]
1,1,2-Trichloro-1,2,2-trifluoromethane	ND	ND	< 2	< 2	< 1	--
Methyl ethyl ketone	ND	ND	< 26	< 26		--
2,4-Dimethylphenol	ND	ND			< 1	NCA
Phenol	ND	ND	< 0.2	< 0.2	< 1	3,500[c]
Butyl benzyl phthalate	< 10	ND			< 1	NCA
Bis(2-chloroethyl)ether	ND	ND			< 1	0.3[d]
1-2-Dichlorobenzene	ND	ND			< 1	400[c]
Diethyl phthalate	< 10	< 10			< 1	350,000[c]
Dimethyl phthalate	ND	ND			< 1	313,000[c]
Di-n-butyl phthalate	< 10	ND			< 1	34,000[c]
Bis(2-ethylhexyl)phthalate	< 10	< 10	< 0.35	< 0.35	< 1	15,000[c]
Isophorone	ND	ND			< 1	5,200[c]
n-Nitrosodimethylamine	ND	ND			< 1	--

ND = Not Detected
NCA = Insufficient data available upon which to derive a criterion.
Blank indicates parameter not analyzed.
[a] Parameters listed are only those that vary substantially from upstream value. See Appendix A for complete results.
[b] For the protection of human health assuming a daily ingestion of 2 liters of water, 1982.
[c] Toxicity criteria.
[d] Carcinogenicity criteria at the 10^{-5} risk level.
[e] Criteria applies to total trivalent arsenic.



LEGEND

NORTHSIDE SANITARY LANDFILL

ECC SITE

APPROXIMATE SAMPLE LOCATIONS

SAMPLE LOCATION WITH AT LEAST ONE CONTAMINANT ABOVE EPA WATER QUALITY CRITERIA

0 2000 4000
SCALE IN FEET

FIGURE 3-4
HISTORICAL SURFACE WATER SAMPLE LOCATIONS
ECC RI REPORT

Table 3-7
HISTORICAL OFFSITE SURFACE WATER SEDIMENTS (ug/kg)
SAMPLING RESULTS
ECC SITE

Sediment Quality Parameter[a]	SAMPLE LOCATION DOWNSTREAM OF ECC									SAMPLE LOCATIONS UPSTREAM OF ECC				
	S	A			C		E	Q	R	N	O	P		
	10/26/82	08/25/80	03/10/81	10/26/82	08/25/80	03/10/81	03/10/81	03/10/81	03/10/81	03/10/81	08/25/80	08/25/80	03/10/81	10/26/82
Arsenic	< 1,000	1,000	5,700	1,000	3,000	4,400	10,000	5,200	8,800	6,500	< 1,000	2,000	6,600	1,000
Chromium	3,000	10,000	9,000	40,000	60,000	6,000	9,000	3,000	11,000	4,000	10,000	13,000	3,000	4,000
Copper	8,000	20,000	27,000	21,000	20,000	8,000	20,000	10,000	16,000	11,000	20,000	20,000	8,000	11,000
Lead	30,000	50,000	160,000	120,000	80,000	48,000	11,000	18,000	89,000	17,000	20,000	30,000	7,000	20,000
DDD	0.5	< 0.1		3.3	< 0.1						< 0.1	0.6		0.7
PCB's	5	120	< 1,000	72	10	< 1,000	< 1,000	< 0.5	< 1,000	< 1,000	1	10	< 1,000	13

[a] Sediment quality parameters listed are only those that vary substantially from upstream values.

GLT424/29

level greater than upstream values. Six compounds were reported at levels above upstream values: arsenic, chromium, copper, lead, DDD and PCB's.

GROUNDWATER

Sampling and Testing

Sampling and testing of groundwater from monitoring wells at ECC is summarized in Table 3-8. Two monitoring wells were located onsite (Figure 3-5). Sampling has been performed by the ISBH on four occasions and by John Bankert on one occasion. Sampling results from the seven monitoring wells located along the perimeter of NSL are not summarized here.

Documentation of sampling and testing procedures was not found with any of the data. ISBH testing procedures are as described earlier. Testing procedures by O.A. Laboratories, Inc., laboratory for John Bankert, were not researched since only two samples were subjected to limited analyses.

Results

Analytical results are summarized in Table 3-9. Complete organic and inorganic priority pollutant analyses were not performed on any groundwater samples. For the samples tested, inorganic pollutants were not found at levels exceeding EPA water quality criteria. Two of the twelve organic priority pollutants were detected at levels above EPA water quality criteria. These were methylene chloride and trichloroethene. Other organic pollutants reported at levels above the detection limit were: 1,2-dichloroethane, 1,1-dichloroethane, 1,2-trans-dichloroethene, 1,1,1-trichloroethane, methyl ethyl ketone, toluene and isophorone.

RESIDENTIAL WELL WATER

Sampling and Testing

Residential well water sampling and testing activities are summarized in Table 3-10. Four sampling episodes were performed by the ISBH and one by Ira Jennings, a homeowner near ECC. Locations of the residential wells sampled are shown in Figure 3-6.

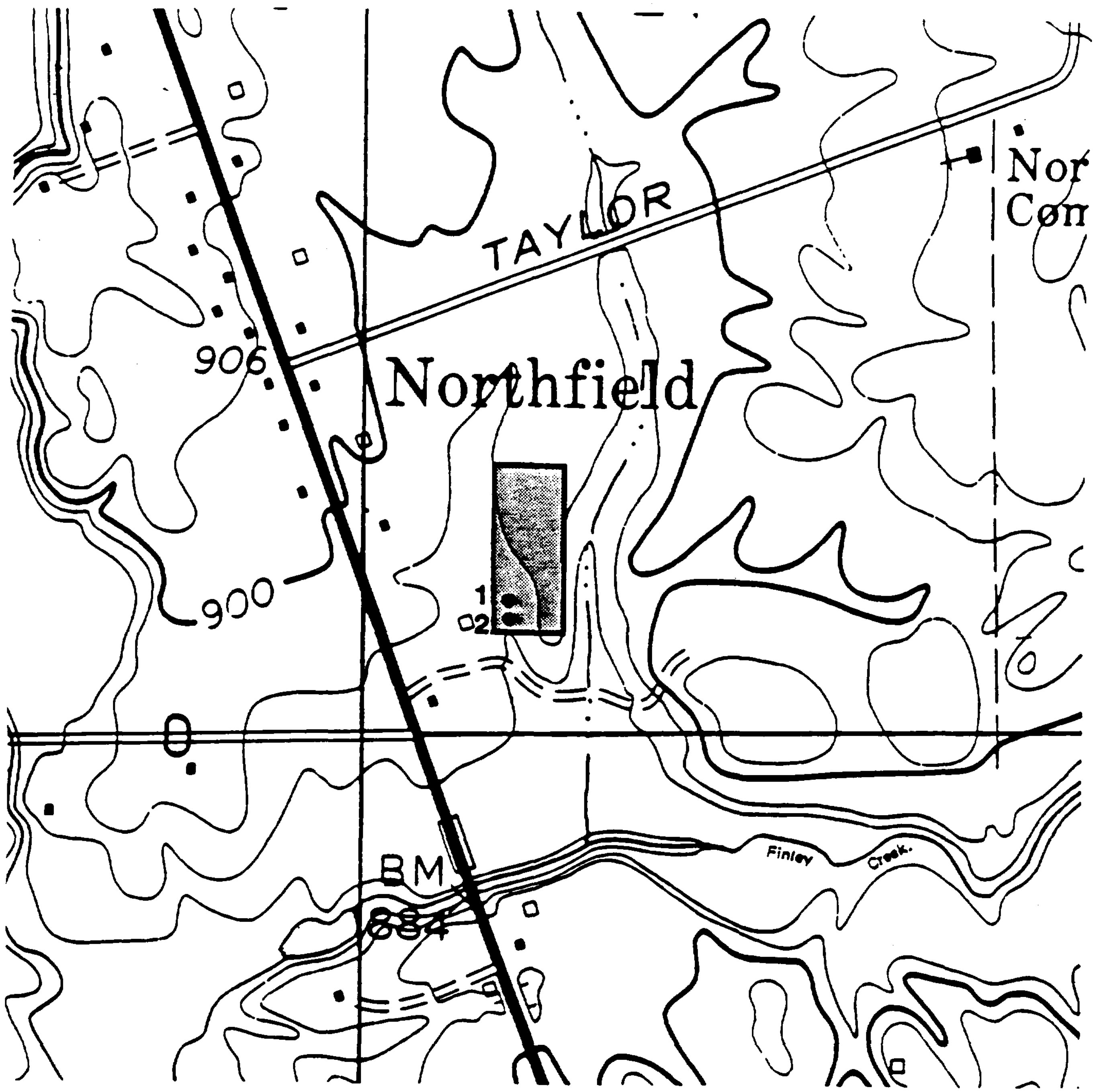
Documentation of sampling and testing procedures was not found with any of the data. ISBH testing procedures are as described earlier. Sampling of the Ira Jennings well was by Mr. Jennings. The sampling procedures used by him are unknown. Analysis of the sample was performed by Environmental Consultants, Inc. Testing and quality control procedures employed by the laboratory were not researched since only one sample was analyzed.

Table 3-8
HISTORICAL GROUNDWATER SAMPLING
ECC SITE

Sampler	Sampling Date	Analytical Laboratory	Document Number	Monitoring Well Location[a]	No. of Samples	Parameters Analyzed	Data Summary
John Bankert	9/15/76	O.A. Laboratories	19	1, 2	2	pH, COD, Fe, Cr, Cr^{+6}, Ni, Pb, Zn, Cd, Cl^-	Table 3-9
ISBH	8/14/79	Water Laboratory, ISBH	29	1, 2	2	Cl^-, Fe, COD, TS, Hardness, Sulfates	None
ISBH	3/17/81	Water Laboratory, ISBH	86	1, 2	2	Metals, volatile organics, others	Table 3-9
ISBH	7/2/81	Water Laboratory, ISBH	121	1, 2	2	Metals, volatile organics, others	Table 3-9
ISBH	11/29/82	Water Laboratory, ISBH Hygrid Laboratory	243	2	2	Metals, volatile organics, others	Table 3-9

[a] Well depths as follows: 1 = 71', 2 = 36'

GLT424/31



LEGEND

- ● APPROXIMATE MONITORING WELL LOCATION

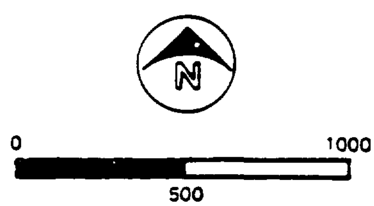


FIGURE 3-5
ECC MONITORING WELL LOCATIONS (1982)
ECC RI REPORT

Table 3-9
HISTORICAL GROUNDWATER SAMPLING (ug/L)
ECC SITE

Water Quality Parameter	MONITOR WELL 1			MONITOR WELL 2					EPA Water Quality Criteria[a]
	09/15/76	03/17/81	07/02/81	09/15/76	03/17/81	07/02/81	01/29/82	01/29/82	
Aluminum		< 100			100				
Arsenic		50	150		2.6	0.2	38	32	0.022[c,d]
Barium			130			50			--
Copper		< 4	< 4		18	< 4			NCA
Chromium	< 100	< 10	15	< 100	< 10	< 10			50[b,e]
Cyanide		< 5			< 5				200[b]
Cadmium	< 100	< 2	< 2	< 100	< 2	< 2	< 2	< 2	10[b]
Iron	2,600		2,000	32,000		< 50			--
Lead	< 100	< 10	< 10	< 100	< 10	< 10	< 10	10	50[b]
Magnesium		88,000			88,000				--
Nickel	< 100	< 10	< 10	< 100	< 10	< 10			13.4[b]
Strontium		1,000			50				--
Zinc	70	10	< 10	290	790	< 10			NCA
TOC			3,900			2,100	28	31	--
COD	16,000	< 5,000	26,000	125,000	< 5,000	10,000	240	220	--
pH (lab)	8.18	7.7	8.0	8.55		7.6	7.1	7.1	--
1,2,-Dichloroethane		< 1	< 1		< 12	2.4	< 10	< 100	9.4[c]
1,1 Dichloroethane		< 1	< 1		50	41	160	130	NCA
1,1 Dichloroethene			< 1		< 1	< 1	< 2	< 1	0.33[c]
1,2 Transdichloroethene		< 1	< 1		< 1	< 1	580	500	NCA
Methylene Chlorine		< 1	< 1		5.7	< 1	14	32	1.9[c]
Trichloroethene		< 1	< 1		10	58	7.6	< 10	27[c]
Tetrachloroethene		< 1	< 1		< 1	< 1	< 10	< 100	8[c]
Trichlorofluoromethane		< 2	< 1				< 10	< 10	1.9[c]
1,1,1 Trichloroethane		< 1	< 1			1.2	30	< 100	18,400[b]
Chloroform			< 1			< 1	< 10	< 100	1.9[c]
1,1,2 Trichloro-1,2,2-trifluoromethane		< 2			< 2		ND	ND	--
bis(2-ethylhexyl)phthalate		< 350			< 350				15,000[b]
Methyl ethyl ketone		< 25	< 26		< 25	< 26	2,300	2,600	--

Table 3-9 (Continued)

Water Quality Parameter	MONITOR WELL 1 09/15/76	MONITOR WELL 1 03/17/81	MONITOR WELL 1 07/02/81	MONITOR WELL 2 09/15/76	MONITOR WELL 2 03/17/81	MONITOR WELL 2 07/02/81	MONITOR WELL 2 01/29/82	MONITOR WELL 2 01/29/82	EPA Water Quality Criteria[a]
Phenol		< 200			< 200				3,500[b]
Ethyl benzene			< 4			< 4	13	13	1,400[b]
Toluene		< 4	< 4		< 4	5.5	13	15	14,300[b]
Xylene		< 8	< 8		< 4	< 8	< 60	< 60	--
Diazanon		< 0.3			< 0.3				--
Isophorone							47	110	5,200[b]
PCB		< 0.5			< 0.5				0.00079[c]

NCA = Insufficient data available upon which to derive a criterion.

Blank indicates parameter not analyzed.

[a] For the protection of human health assuming a daily ingestion of 2 liters of water, 1982.

[b] Toxicity criteria.

[c] Carcinogenicity criteria at the 10^{-5} risk level.

[d] Criteria applies to total trivalent arsenic.

[e] Criteria applies to total hexavalent chromium.

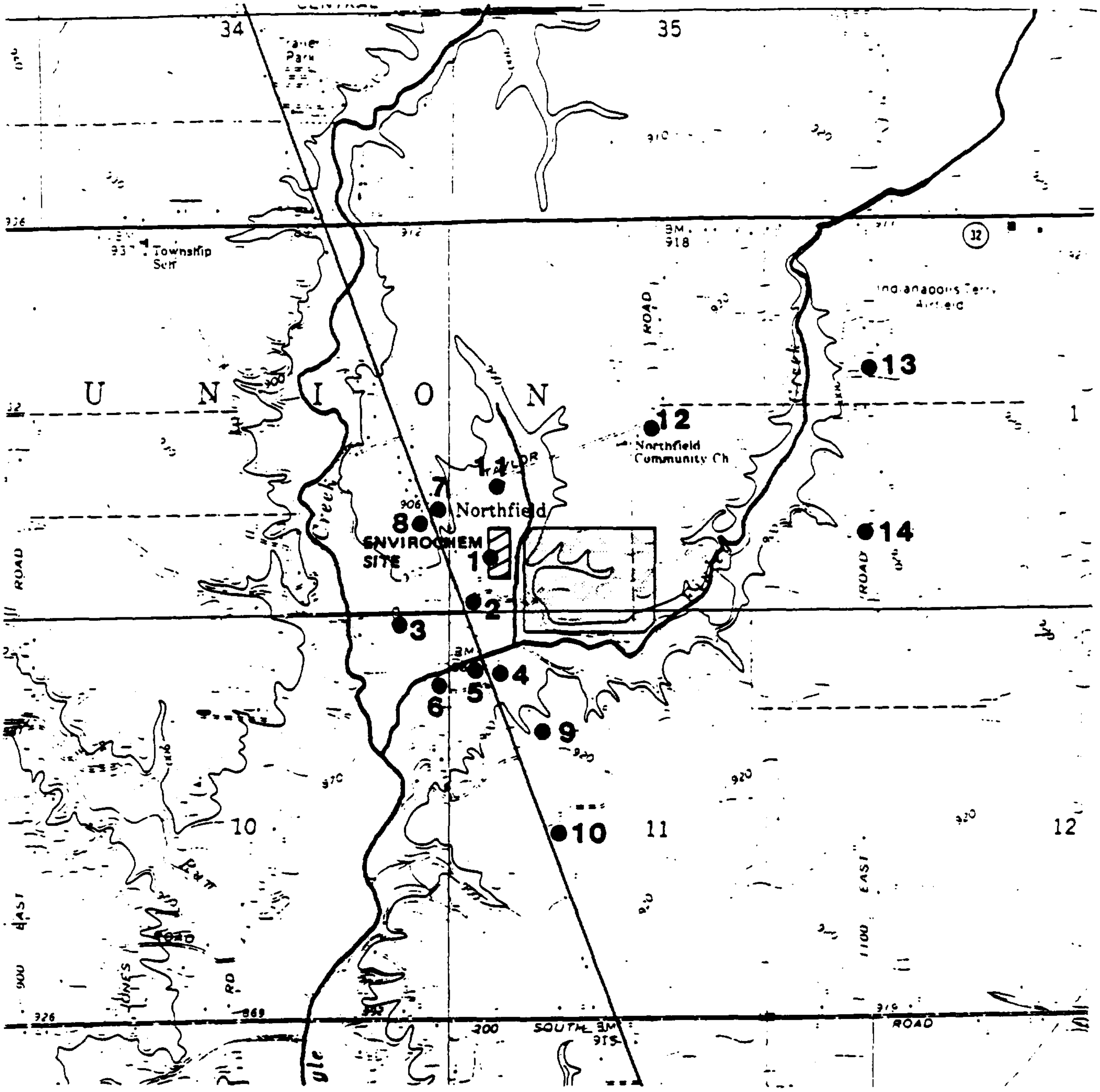
GLT424/33-2

Table 3-10
HISTORICAL RESIDENTIAL WELL WATER SAMPLING
ECC SITE

Sampler	Sampling Date	Analytical Laboratory	Document Number	Sampling Location	No. of Water Samples	Parmeters Analyzed	Data Summary
ISBH	8/14/79	Water Laboratory, ISBH	29	2	1	Cl^-, COD, Fe, Hardness, Sulfate	Table 3-11
ISBH	9/5/80	Water Laboratory, ISBH	71	3, 7, 9, 10, 13	5	Cd, Cr^{+6}, COD, Cu, Fe, Pb, pH, phenol, TOC Hardness, Cl^-	Table 3-11
ISBH	3/5/81	Water Laboratory, ISBH	83	1, 2, 4, 5, 6, 7, 11, 12, 14	9	Metals, PCB, volatile organics, others	Tables 3-11,
Ira Jennings	6/26/82	Environmental Consultants, Inc.	241	8	1	Metals, methylene chloride, 1,1,2 trichloroethane, tetrachloroethene	Table 3-11
ISBH	12/9/82	Water Laboratory, ISBH	242	1	1	Volatile organics, others	None[a]

[a] No parameters with values above detection limits.

GLT424/32



LEGEND

NORTHSIDE SANITARY LANDFILL

ECC SITE

RESIDENTIAL WELLS SAMPLED

0 2000 4000

SCALE IN FEET

FIGURE 3-6
HISTORICAL RESIDENTIAL WELL SAMPLING LOCATIONS
ECC RI REPORT

Results

Analytical results are summarized in Tables 3-11 and 3-12. Table 3-11 is a summary of residential well water sampling results for water quality parameters where levels above detection limits were reported. Table 3-12 is a list of additional organic pollutants analyzed by ISBH and not found above detection limits in any wells. Complete organic and inorganic priority pollutant analyses were not performed on any well water samples prior to the onset of Superfund activities at the site.

The sample of the Ira Jennings well (well No. 8) was the only sample where a water quality parameter was detected at levels above the EPA water quality criteria. Lead, methylene chloride, 1,1,2-trichloroethane and tetrachloroethene were found to be above the EPA water quality criteria.

SOIL

Sampling and Testing

Sampling and testing of soil at ECC has been limited to one sample obtained by ISBH on March 2, 1979, from the dike between the cooling water pond and the unnamed ditch. Documentation of sampling and testing procedures was not found with the data.

Results

Analysis of the soil sample was limited to four parameters as follows:

- COD 30,000 ug/kg
- Pb < 1,000 ug/kg
- Hg 65,000 ug/kg
- Phenol 300 ug/kg

AQUATIC BIOTA

Sampling and Testing

Two studies, a bioaccumulation study on freshwater mussels and a biological assessment of stream ecosystems, have been performed in the vicinity of ECC. In the first study, the ISBH suspended live freshwater mussels, (*Lampsilis radiata siluoides*) in wire baskets at four locations on April 24, 1981, (Figure 3-7). On June 9, 1981 the mussels were taken out of the streams, wrapped in solvent-rinsed aluminum foil, and kept frozen until analyzed. Each sample consisted of five mussels.

Table 3-11
HISTORICAL RESIDENTIAL WELL WATER SAMPLING RESULTS (ug/L)
ECC SITE

	1	2		3	4	5	6	7		8	9	10	11
Water Quality Parameter	03/05/81	08/04/79	03/05/81	09/05/80	03/05/81	03/05/81	03/05/81	09/05/80	03/05/81	06/26/82	09/05/80	09/05/80	03/05/81
Aluminum	< 100		< 100		< 100		< 100		< 100				< 100
Arsenic	0.9		0.8		< 0.2	< 0.2	0.3		3.1	10			0.4
Beryllium	< 10		< 10		< 10	< 10	< 10		< 10				< 10
Cadmium	< 2		< 2	< 2	< 2	< 2	< 2	< 2	< 2	9	< 2	< 2	< 2
Chromium-hex.	< 10		< 10	< 10	< 10	< 10	< 10	< 10	< 10		< 10	< 10	< 10
Chromium-tot.	< 10		< 10		< 10	< 10	< 10		< 10	< 3			< 10
Cyanide (free)	< 5		< 5		< 5	< 5	< 5		< 5				< 5
Iron	960	3,100	3,000	2,850	1,000	1,100	1,100	3,050	2,600		260	2,800	2,800
Lead	< 10		< 10	< 20	< 10	< 10	< 10	< 20	< 10	93	< 20		< 10
Mercury	< 0.1		< 0.1		< 0.1	< 0.1	< 0.1		< 0.1	< 0.5			< 0.1
Strontium	500		500	700	700	800		500				700	
Copper				11	< 4	< 4		< 4	< 4		26	< 4	6
Phenol				< 5				< 5			< 5	< 5	
Barium										403			
TOC				5,200				< 1,000			2,400	3,000	
COD		8,000		14,000				7,000			9,000	11,000	
Hardness ($CaCo_3$)	272,000	332,000	356,000	248,000	268,000	272,000	272,000	424,000	432,000		224,000	288,000	348,000
Chlorides	< 5,000	7,000	10,000	< 5,000	< 5,000	< 5,000	< 5,000	16,000	15,000		6,000	5,000	7,000
pH (lab)	6.9		6.7	7.0	6.9	6.9	6.9	6.7	6.6		7.1	7.1	6.8
Methylene Chloride										20			
1,1,2 trichloroethane										31			
tetrachloroethene	< 1		< 1		< 1	< 1	< 1		< 1	46			< 1

GLT424/34-1

Table 3-11 (Continued)

Water Quality Parameter	12 03/05/81	13 09/05/80	14 03/05/81	EPA Water Quality Criteria[a]
Aluminum	< 100		< 100	--
Arsenic	16		26	0.022[c,d]
Beryllium	< 10		< 10	0.68[c]
Cadmium	< 2	< 2	< 2	10[b]
Chromium-hex.	< 10	< 10	< 10	50[b]
Chromium-tot.	< 10		< 10	170,000[b]
Cyanide (free)	< 5		< 5	200[b]
Iron	3,900	1,030	2,300	--
Lead	< 10	< 20	< 10	50[b]
Mercury	< 0.1		< 0.1	0.144[b]
Strontium	1,000		1,500	--
Copper	< 4	< 4	< 4	NCA
Phenol		< 5		3,500[b]
Barium				--
TOC		5,500		--
COD		14,000		--
Hardness ($CaCo_3$)	300,000	188,000	258,000	--
Chlorides	9,000	< 5,000	< 5,000	--
pH (lab)	6.9	7.3	6.9	--
Methylene Chloride				1.9[c]
1,1,2 trichloroethane				6.0[c]
tetrachloroethene	< 1		< 1	8.0[c]

NCA = Insufficient data available upon which to derive a criterion.
Blank indicates parameter not analyzed.
[a] For the protection of human health assuming a daily ingestion of 2 liters of water, 1982.
[b] Toxicity criteria.
[c] Carcinogenicity criteria at the 10^{-5} risk level.
[d] Criteria applies to total trivalent arsenic.

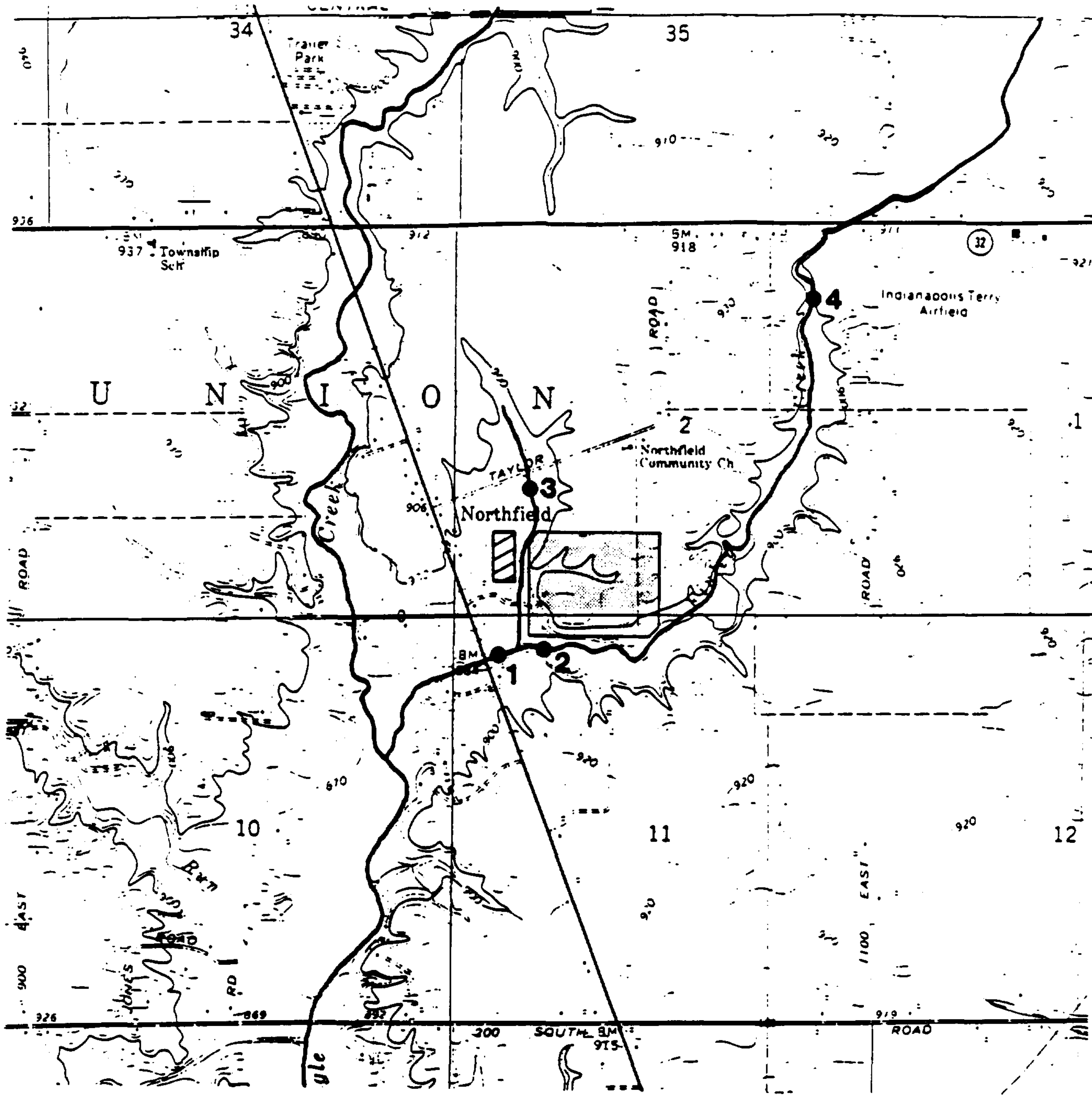
GLT424/34-2

Table 3-12
RESIDENTIAL WELL WATER SAMPING ANALYSIS
ORGANICS (ppb)
ISBH SAMPLING 3/5/81[a]

Parameter	Dectection Limit
Pyridine	< 1,000
Cresol	< 200
Heptaclor	< 0.02
Chloridane	< 0.24
Toluene	< 3
MIBK	< 12
Methyl ethyl ketone	< 26
Malathion	< 1.1
O-xylene	< 3
Benzene	< 3
1,1 dichloroethane	< 1
1,2 dichloroethene	< 1
trichlorofluoromethane	< 1
dichlorodifluoromethane	< 1
tetrachloroethene	< 1
trichloroethene	< 1
vinyl chloride	< 1
strobane	< 1
diazinon	< 0.3
dimethyl phenanthrene	< 500
trimethyl phenanthrene	< 500
PCB arochlor 1016	< 0.5
PCB arochlor 1242	< 0.5
PCB arochlor 1254	< 0.5
PCB arochlor 1260	< 0.5

[a] All nine residential well samples were reported to be below the detection limits for the parameters listed above.

GLT424/35



LEGEND

NORTHSIDE SANITARY LANDFILL

ECC SITE

N

0 2000 4000

SCALE IN FEET

FIGURE 3-7
HISTORICAL BIOACCUMULATION STUDY SITES
ECC RI REPORT

The second study was performed by the Department of Zoology, Depauw University, from 1978 to 1980 as part of a larger biological monitoring program of fish populations and benthic macroinvertebrates. One of the watersheds studied was the Eagle Creek watershed, including Finley Creek. Figure 3-8 shows the locations of sample stations. Fish were collected using an electric seine. After being stunned, they were placed in live nets for later identification. Three passes were made in each stream stretch. Benthic macroinvertebrates were collected with a square foot Surber sampler and a long handled dip net. Three replicates were collected at each station with each sampling device. Sampling normally took place once a month in May, June, July, August and October in 1978, 1979 and 1980. More complete sampling method descriptions are available in the report, "The Biological Monitoring Program of the Indiana MIP," by J.R. Gammon, M.D. Johnson, C.E. Mays and D.A. Schiappa.

Results

Analytical results from the mussel bioaccumulation study are presented in Table 3-13. The only parameter to be reported at levels higher downstream than upstream of ECC was arsenic.

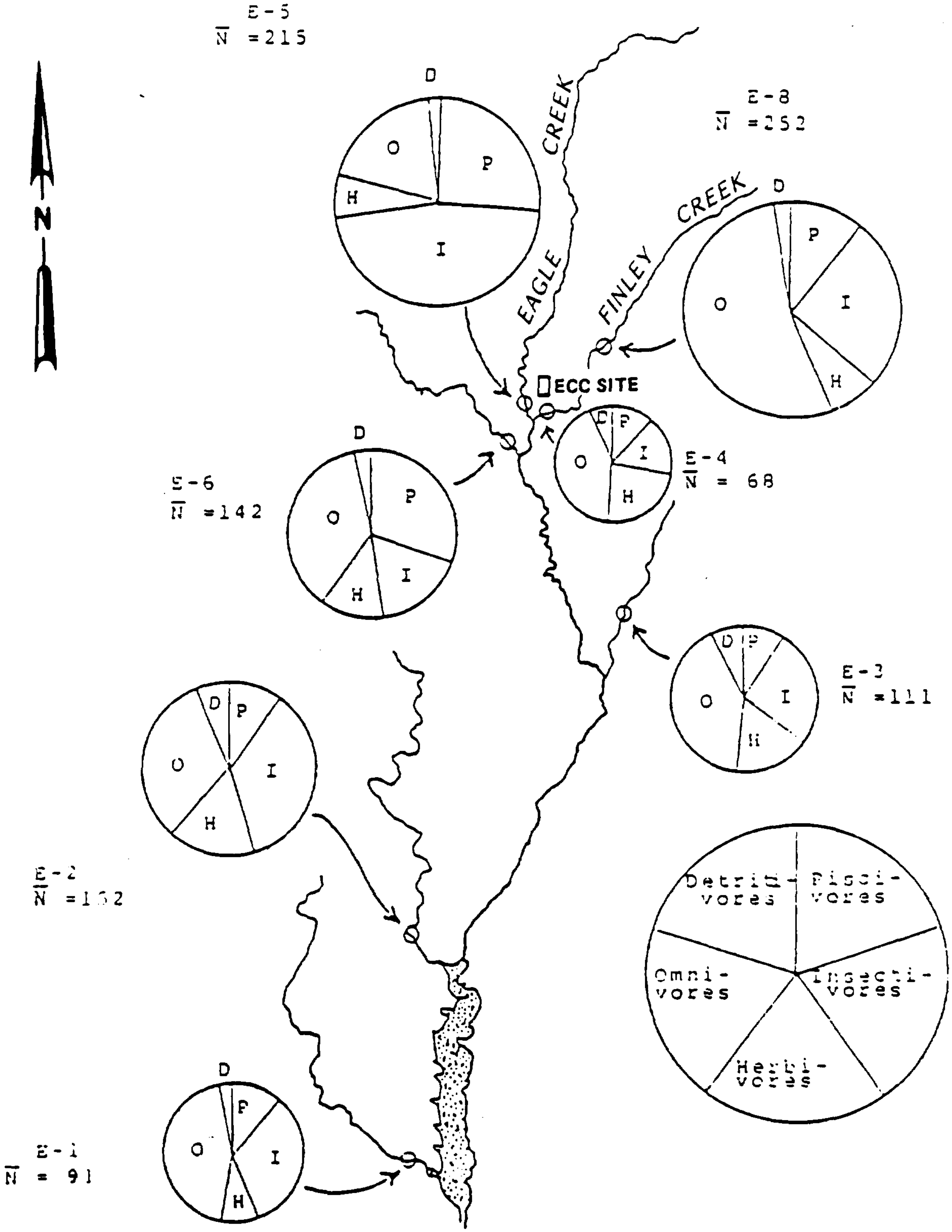
Results of the Biological Monitoring Program assessment of fish population are shown in Figure 3-8. The mean standing crop of fish is much less at downstream station E4, compared to upstream station E8. Data on macroinvertebrates presented in the report is limited to a ranking of sample stations according to density, biomass or number of families (Table 3-14). Station E4 consistently ranked low in each category.

PREVIOUS REMOVAL MEASURES

During March and April 1983, U.S. EPA removed and treated approximately 850,000 gallons of water from the cooling water pond to prevent overflows to the unnamed ditch.

Chemical Waste Management Inc. (Chem Waste) was hired by the U.S. EPA to conduct the ECC site surface cleanup. Chem Waste began onsite activities at ECC on July 11, 1983. On November 9, 1983, a Consent Decree was entered in U.S. District Court whereby some of the generators of waste sent to the site provided funding for completion of removal activities. Work under the Consent Decree was substantially completed on August 8, 1984. Tasks completed during this time period included:

- Sampling and fingerprint testing of 29,192 drums.
- Shipment offsite to a licensed hazardous waste disposal facility of 20,349 drums of waste.



Trophic composition (weight) of the fish communities of Eagle Creek tributaries during 1978-80. Mean standing crop ($\bar{N}$) in kilograms per hectare.

SOURCE: The Biological Monitoring Program of the Indiana MIP.
J.R. Gammon, M.D. Johnson, C.E. Mays, and D.A. Schiappa.
Department of Zoology, Depauw University.

FIGURE 3-8
FISH POPULATION ASSESSMENT (1980)
ECC RI REPORT

Table 3-13
FRESHWATER MUSSEL
BIOACCUMULATION STUDY (ug/kg)
ECC SITE

PARAMETER	SAMPLE LOCATION DOWNSTREAM OF ECC		SAMPLE LOCATIONS UPSTREAM OF ECC							FDA ACTION LEVEL[b]
	1A	1B	2A	2B	3A	3B	4A	4B		
Fat (%)	51	51	58	60	41	57	87	98		
Arsenic	740	750	480	560	540	620	500	580		
Cadmium	300	340	260	320	320	300	220	280		
Chromium	400	400	< 200	600	400	200	300	1,000		
Copper	1,400	1,100	1,400	1,100	800	1,000	800	1,200		
Lead	< 800	< 800	< 800	< 800	< 800	< 800	< 800	< 800		
Mercury	< 30	< 30	< 300	< 200	< 300	< 200	< 300	< 200		1,000
Silver	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100		
Aldrin	ND	ND	ND	ND	ND	ND	ND	ND		
Dieldrin	LOST[a]	7	4	5	1	2	2	5		300
Chlordane	LOST[a]	7	5	5	17	18	6	6		300
DDT	ND	ND	ND	ND	ND	ND	ND	ND		
Heptachlor	ND	ND	ND	ND	ND	ND	ND	ND		
Diazinon	ND	ND	ND	ND	ND	ND	ND	ND		
Strobane	ND	ND	ND	ND	ND	ND	ND	ND		
Malathion	ND	ND	ND	ND	ND	ND	ND	ND		
PCB's	ND	ND	ND	ND	ND	ND	ND	ND		

[a] Sample Lost
[b] Federal Food and Drug Administration Action Level for substances in fish and shellfish

GLT90/68

Table 3-14
MACROINVERTEBRATES
ECC SITE

RANK OF EAGLE CREEK STREAMS[a]

Stream Mean Pool Depth	Fish (Composite Index)	Bivalvia (Density)	Tipulidae (Biomass)	Ephemeroptera (# of Families)	Baetidae (Density)
1. Mounts Run - E6	1. E5	1. E5	1. E5	1. E5	1. E5
2. Eagle (upper) - E5	2. E6	2. E2	2. E3	2. E6	2. E6
3. Fishback - E2	3. E2	3. E3	3. E2	3. E7	3. E7
4. Eagle (lower) - E7[b]	4. E3	4. E7	4. E6	4. E2	4. E2
5. Little Eagle - E3	5. E1	5. E6	5. E7	5. E3	5. E3
6. Finley - E4	6. E4	6. E4	6. E1	6. E4	6. E4
7. School Branch - E1	7.	7. E1	7. E4	7. E1	7. E1

[a] Invertebrates from Surber only.
[b] No fish samples taken.

Source:
The Biological Monitoring Program of the Indiana MIP. J.R. Gammon, M.D. Johnson, C.E. Mays and D.A. Schiappa. Department of Zoology, Depauw University.

GLT90/69

- Crushing onsite and shipment offsite to a licensed hazardous waste disposal facility of 9,558 empty drums.

- Removal and shipment offsite to licensed disposal facilities of 282,500 gallons of liquids bulked from drums.

- Removal and shipment offsite to licensed disposal facilities of 219,940 gallons of pumpable liquid hazardous wastes from the tanks (primarily flammable solvents).

- Excavation and shipment offsite to licensed disposal facilities of about 5,200 yd^3 of contaminated soil and cooling water pond sludge.

- Removal and shipment offsite to a licensed hazardous waste treatment facility of about 4,500,000 gallons of contaminated cooling pond water.

- Excavation and shipment offsite to a licensed disposal facility of 452 yd^3 of contaminated soils from the polymer solidification pit.

- Pressure washing of the concrete pad (about 27,000 ft^2).

- Cleaning of the processing building and equipment.

On August 1, 1984, U.S. EPA approved funding to undertake further surface cleanup work, some of which was reimbursed by the Consent Decree entered in November 1983. The following activities were completed:

- Removal of remaining sludge from the bottom of the cooling water pond, and onsite containment.

- Removal of remaining sludge from the bulk storage tanks.

- Cleaning and/or disposal of the bulk tanks.

- Removal of two underground tanks.

- Removal of a leaking PCB-filled transformer.

- Removal of miscellaneous piping.

- Placement of a clay cover on the surface of the site, including filling in of the cooling water pond.

Remaining on the ECC site are some empty bulk tanks, the cleaned processing building with equipment, and additional areas of contaminated soils, including area beneath the concrete pad.

GLT424/121

Chapter 4
ANALYSIS OF SITE INVESTIGATIONS

SOIL INVESTIGATIONS

SCOPE AND METHODS

The purpose of the soil investigation was to collect data on the depth, areal extent and concentrations of hazardous constituents at potential contaminant source areas on the ECC site. An additional objective was to evaluate the dikes and embankments as possible sources of uncontaminated soil that could be used as cover material for potential remedial actions. A detailed summary of scope and methods is presented in TM 3-4 of Appendix A.

Soil sampling was performed in two phases, the first from May 7 through May 9, 1984, and the second, October 22 through October 26, 1984. In Phase 1, 18 surficial soil samples were taken along the north and west site embankments. Also, soil samples were collected from 2.5 foot deep soil borings with 2 inch diameter hand augers at 15 locations (Figure 4-1). Samples were screened for volatile organic contaminants (VOC's) using a field Organic Vapor Analyzer (OVA) and headspace analysis. The screening was used to select samples for the full CLP organic analysis. Site conditions were not favorable during Phase 1 sampling due to wet and muddy soils onsite to depths up to 2 feet. As a result the sampling results are considered indicative of contamination in the upper 2.5 feet of soil and no interpretation relative to variation of contaminants with depth is appropriate.

Phase 2 sampling consisted of nine soil borings to depths up to 12 feet through the concrete pad in the south area of the site and 12 test pits to depths up to 10 feet in the remaining areas of the site (Figure 4-2). Soil borings were advanced with a small drill rig and samples collected at 2 foot intervals with split spoons. Test pits were dug with a backhoe and samples collected at 2 foot intervals with hand augers. Samples were again screened in the field with an OVA and selected samples sent to the CLP for organic and inorganic analysis. Site conditions were more favorable than during Phase 1, although wet conditions did interfere with some of the sample efforts.

RESULTS

Inorganic Constituents

Only soil samples collected during the Phase 2 sampling were sent to the CLP for inorganic analysis. Tables 4-1 through 4-3 present the analytical results for these samples.

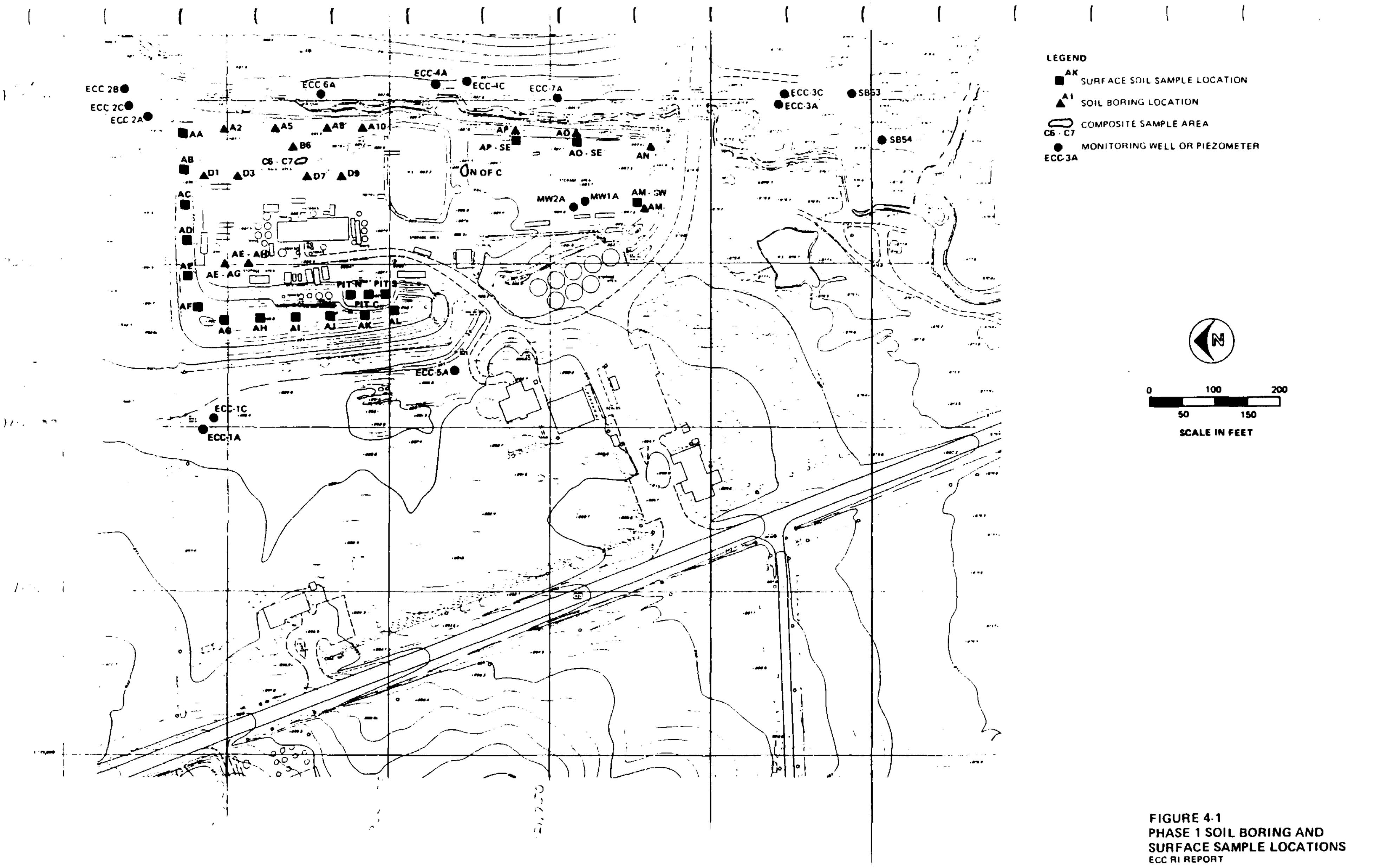
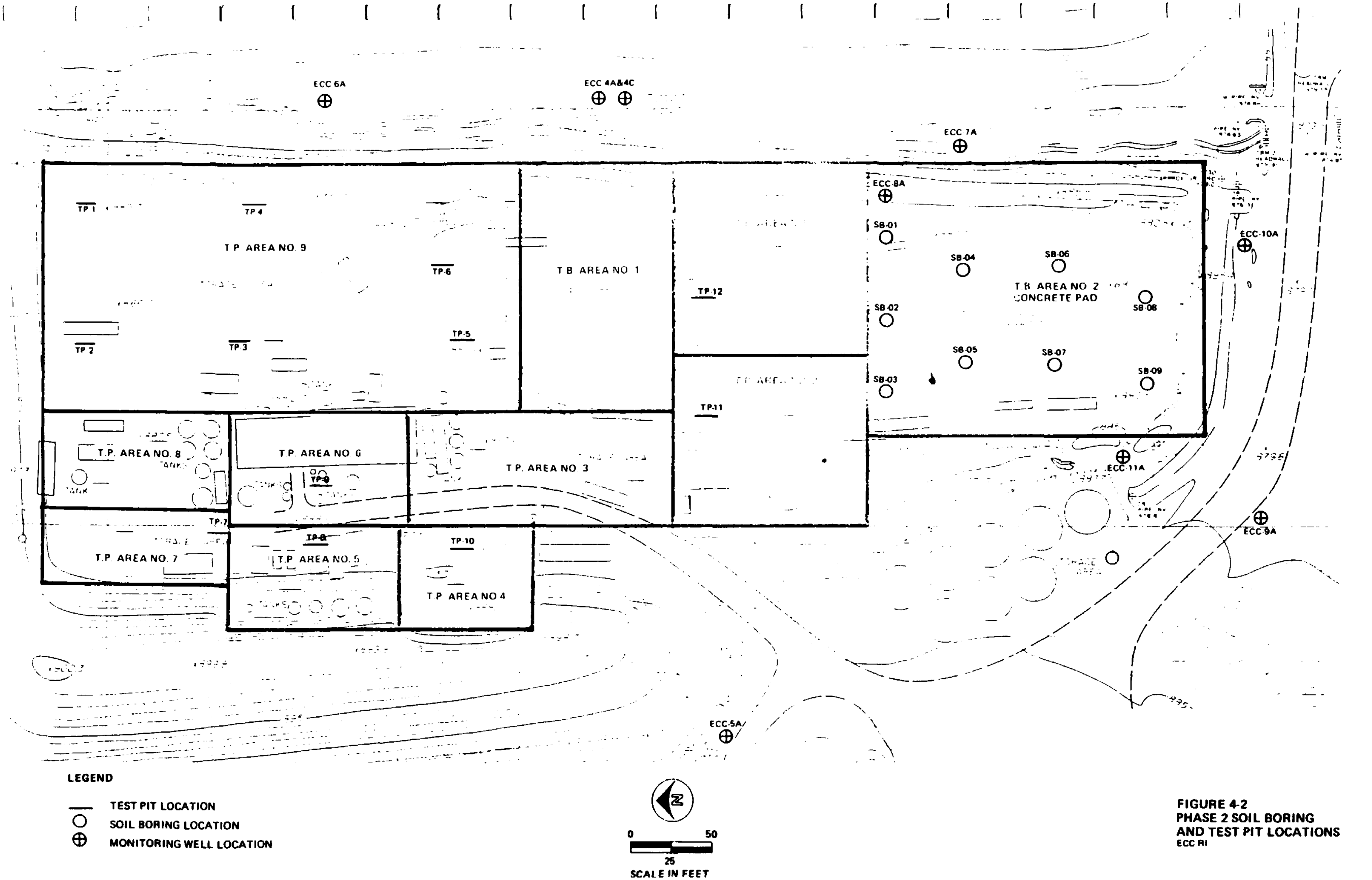


FIGURE 4-1
PHASE 1 SOIL BORING AND SURFACE SAMPLE LOCATIONS
ECC RI REPORT



LEGEND

— TEST PIT LOCATION

○ SOIL BORING LOCATION

⊕ MONITORING WELL LOCATION

FIGURE 4-2
PHASE 2 SOIL BORING AND TEST PIT LOCATIONS
ECC RI

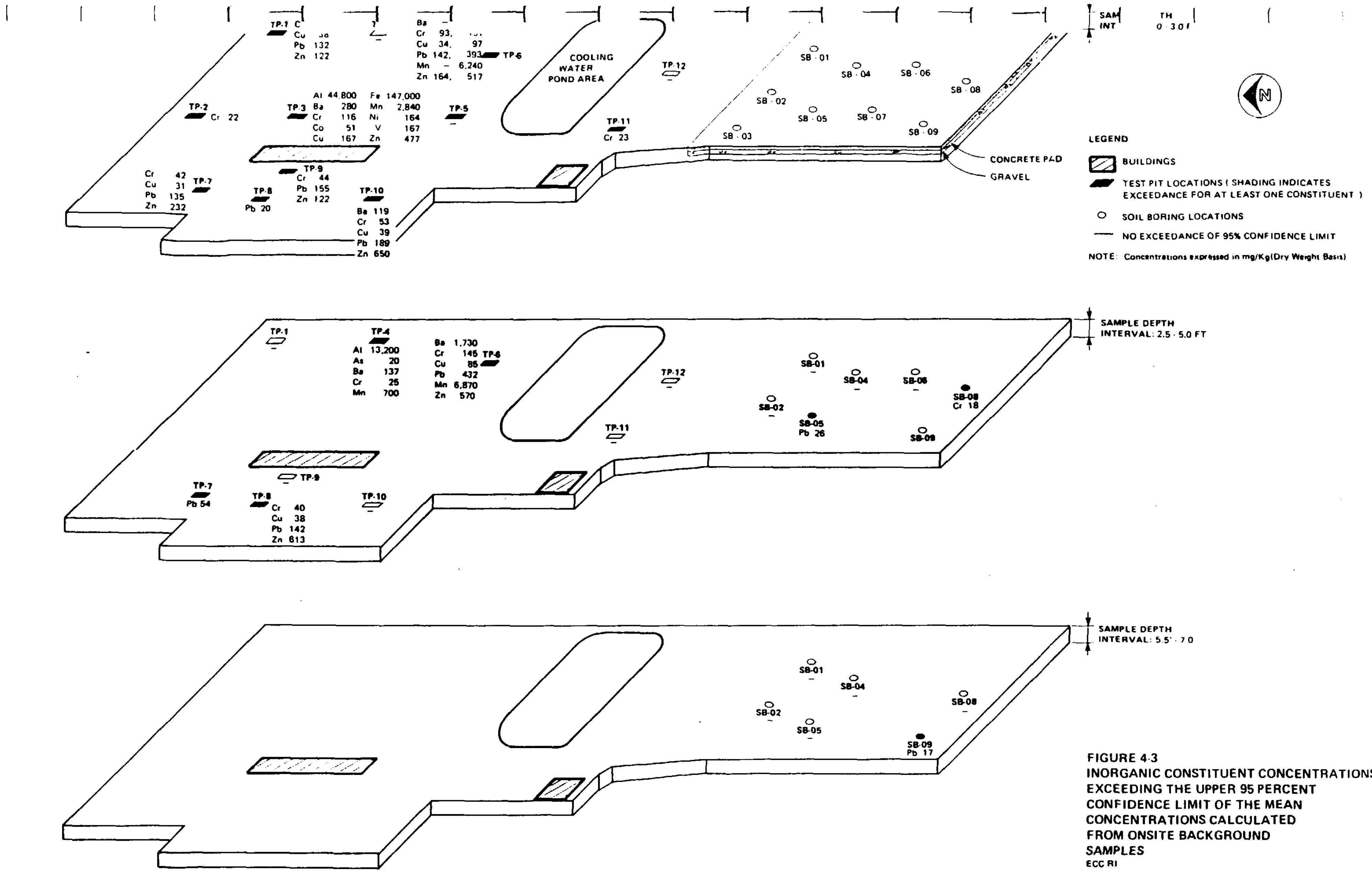


FIGURE 4-3
INORGANIC CONSTITUENT CONCENTRATIONS EXCEEDING THE UPPER 95 PERCENT CONFIDENCE LIMIT OF THE MEAN CONCENTRATIONS CALCULATED FROM ONSITE BACKGROUND SAMPLES
ECC RI

TABLE 4-1
SOIL INORGANIC RESULTS (mg/kg)
TEST PITS
SHALLOW DEPTH SAMPLES
ECC RI Report

Sample Location:	TP-1	TP-2	TP-3	TP-4	TP-5	TP-5	TP-6	TP-6	TP-7	TP-8	TP-9	TP-10	TP-11	TP-12
Depth (ft):	1-1.5	1-1.5	1-1.5	1-2	1-2	2-3	1-2	2-3	1-2.5	1-2.5	1-3	1-3	1-2.5	0.5-3
Date Sampled:	10-22-84	10-22-84	10-22-84	10-22-84	10-22-84	10-22-84	10-22-84	10-22-84	10-23-84	10-24-84	10-24-84	10-24-84	10-24-84	10-24-84
ITR Number:	ME4162	ME4164	ME4165	ME4166	ME4168	ME4169	ME4170	ME4171	ME4177	ME4179	ME4181	ME4183	ME4184	ME4185
INORGANIC COMPOUNDS														
ALUMINUM	6650	9990	44000	8000	4720	4870	8310	7180	4950	5630	3290	8310	10600	5900
ANTIMONY														
ARSENIC	7.1	17	5.6	[5.9]	9.7	16	11	7.4	7.7	11	8.6	[4.8]	6.1	8.9
BARIUM	[82]	[73]	[280]	[65]	[42]	[45]	[82]	1570	[81]	[51]	[82]	[119]	[69]	[49]
BERYLLIUM	[0.6]	[0.64]	[3.9]	[0.47]		[0.37]	[0.45]	[1.4]			[0.79]	[0.56]	[0.67]	[0.44]
CADMIUM	4.1							3.8			4.5			
CALCIUM	65100 *	7950 *	1260000	[2500] *	101000 *	103000 *	23000 *	57800 *	93200 *	110000 *	50100 *	76700 *	3010 *	104000 *
CHROMIUM	55 *	22 *	116	15 *	15 *	12 *	93 *	131 *	42 *	13 *	44 *	53 *	23 *	14 *
COBALT	[8.1]	[14]	[51]	[6.5]	[5.1]	[6.1]	[12]	[12]	[6.8]	[8.1]	[6.8]	[8.3]	[5.8]	[6.6]
COPPER	38	38	167	[13]	18	17	34	77	31	21	28	39	25	20
IRON	16700	27000	147000	15300	15000	15100	15500	18800	13400	16200	11900	19300	23600	17000
LEAD	132 *	13 *	7.8	11 *	9.1	12	142 *	393 *	135 *	20	155 *	189 *	11	8.9
CYANIDE	1.3						0.80		2.9					
MAGNESIUM	19400 *	5790 *	292000	[2060] *	28000 *	30000 *	8800 *	11100 *	41500 *	35100 *	19500 *	22400 *	3040 *	29900 *
MANGANESE	438	485	2840	473	382	327	299	6240	366	371	158	407	109	324
MERCURY														
NICKEL	[20]	37	[164]	[12]	[18]	[19]	[14]	[13]	[5.8]	[11]	[18]	[22]	25	[21]
POTASSIUM	[1290]	[1570]	[10500]		[1160]	[1360]	[1040]	[985]	[2020]	[1140]	[1090]	[1380]	[1040]	[1410]
SELENIUM														
SILVER	[3.8]													
SODIUM		[485]	[15600]		[1270]	[1630]		[630]			[589]			
THALLIUM														
TIN	[21]			[20]	25						[24]	[22]		
VANADIUM	[22]	32	[167]	[22]	[16]	[17]	[24]	33	[15]	[19]	[15]	[24]	35	[19]
ZINC	121 *	90 *	477	43 *	48 *	56 *	164 *	517 *	232 *	73 *	122 *	650 *	82 *	59 *
PERCENT SOLIDS	78%	84%	90%	85%	88%	90%	88%	88%	84%	87%	76%	84%	90%	90%

FOOTNOTES:

E- Value is estimated or not reported due to the presence of interference.
*- Duplicate analysis is not within control limits.
+- Correlation coefficient for method of standard addition is less than 0.995.
[]- Positive values less than the contract required detection limit.

NOTE: CONCENTRATIONS ARE REPORTED ON A DRY WEIGHT BASIS —

TABLE 4-2
SOIL INORGANIC RESULTS (mg/kg)
TEST PITS
INTERMEDIATE DEPTH SAMPLES
ECC Site RI Report

Sample Location: Depth (ft): Date Sampled: ITR Number:	TP-1 4-5 10-22-84 ME4163	TP-4 2.5-3.5 10-22-84 ME4167	TP-6 4-5 10-22-84 ME4172	TP-7 2.5-4 10-23-84 ME4178	TP-8 2.5-4 10-24-84 ME4180	TP-9 3-5 10-24-84 ME4182	TP-10 3-5 10-24-84 MEA312	TP-11 3-5 10-24-84 MEA313	TP-12 3-5 10-24-84 MEA314
INORGANIC COMPOUNDS									
ALUMINUM	4620	13200	7920	5170	4670	5150	9970	5280	5040
ANTIMONY	42								
ARSENIC	[6.1]	20	[4.9]	8.4		7.5	15	[6.0]	6.2
BARIUM	[33]	137	1730	[49]	[86]	[47]	[63]	[48]	[46]
BERYLLIUM		[0.74]	[1.5]		[2]	[0.43]	[0.40]		
CADMIUM			4.9		27	2.9			
CALCIUM	70100 *	5060 *	63000 *	92000 *	87500 *	97700 *	3800	113000	10000
CHROMIUM	13 *	25 *	145 *	12 *	40 *	12 *	20	13	15
COBALT	[7.1]	[13]	[13]	[8.7]	[9.4]	[7.1]	[11]	[8.5]	[11]
COPPER	19	27	85	19	38	18	22	21	20
IRON	14000	31500	20700	15600	14500	15800	22100	17400	16500
LEAD	8.5	15 *	432 *	54	142 *	15	12	7.7	6.7
CYANIDE				0.96	4.4				
MAGNESIUM	23000 *	3740 *	12300 *	26700 *	25300 *	27400 *	3110	27900	25700
MANGANESE	352	700	6870	479	295	379	204 *	403 *	389 *
MERCURY									
NICKEL	[17]	36	[15]	[13]	[23]	[17]	[24]	[20]	[19]
POTASSIUM	[935]	[1040]	[1030]	[1090]	[1390]	[1260]	[1900]	[1700]	[1500]
SELENIUM									
SILVER		[3.8]							
SODIUM	[1100]		[480]				[634]	[1560]	[1910]
THALLIUM									
TIN					[21]				
VANADIUM	[17]	36	37	[19]	[17]	[17]	31	[19]	[20]
ZINC	53 *	90 *	570 *	62 *	613 *	62 *	70	53	51
PERCENT SOLIDS	82%	81%	82%	89%	78%	93%	82%	84%	89%

FOOTNOTES:

E- Value is estimated or not reported due to the presence of interference.
*- Duplicate analysis is not within control limits.
+- Correlation coefficient for method of standard addition is less than 0.995.
[]- Positive values less than the contract required detection limit.

NOTE: CONCENTRATIONS ARE REPORTED ON A DRY WEIGHT BASIS —

TABLE 4-3
SOIL BORING INORGANIC RESULTS (mg/kg)
ECC Site RI Report

INTERMEDIATE BORINGS

Sample Location:	SB-01	SB-02	SB-04	SB-05	SB-05	SB-06	SB-08	SB-09
Depth (ft):	2.5-4	2.5-4	2-3.5	3-4.5	3-4.5	2-3.5	2.5-4	2.5-4
Date Sampled:	10-24-84	10-22-84	10-24-84	10-24-84	10-24-84	10-23-84	10-24-84	10-24-84
ITR Number:	ME4186	MEA310	MEA320	MEA325	MEA324	MEA318	MEA317	MEA316
INORGANIC COMPOUNDS								
ALUMINUM	5260	4580	6660	4650	5140	5110	6540	5380
ARSENIC	[4.9]	8.6	8.5	10	[4.6]	7.8	7.3	10
BARIUM	[35]	[45]	[54]	[54]	[49]	[35]	[48]	[32]
BERYLLIUM				[.38]		[.36]	[.37]	[.38]
CADMIUM							4.4	
CALCIUM	110000	102000	100000	121000	109000	109000	104000	113000
CHROMIUM	15	12	15	13	12	13	18	14
COBALT	[5]	[11]	[10]	[10]	[9.6]	[6.6]	[11]	[9.5]
COPPER	23	18	25	21	21	20	26	20
IRON	16000	15300	19000	19200	16100	14400	20500	16400
LEAD	7.2	9.3	9.1	26	5.6	8.3	9	7.7
MAGNESIUM	26400	28600	27300	27000	30400	33300	28700	34100
MANGANESE	289 *	344 *	451 *	409 *	314 *	306 *	401 *	316 *
NICKEL	[13]	[15]	23	[19]	[18]	[18]	24	[13]
POTASSIUM	[1400]	[1630]	[1750]	[1550]	[1750]	[1640]	[2030]	[1450]
SILVER							[3.3]	
SODIUM	[859]	[944]	[1640]	[1090]	[980]	[1290]	[1400]	[1390]
TIN			30	19	17			
VANADIUM	[20]	[16]	[23]	[18]	[20]	[19]	[25]	[20]
ZINC	51	47	69	54	66	55	68	56
PERCENT SOLIDS	90%	81%	88%	92%	90%	90%	89%	91%

DEEP BORINGS

Sample Location:	SB-01	SB-02	SB-04	SB-05	SB-05	SB-08	SB-09
Depth (ft):	5.5-7	5.5-7	5-6.5	7.5-9	7.5-9	7-8.5	5.7-7
Date Sampled:	10-22-84	10-22-84	10-24-84	10-24-84	10-24-84	10-24-84	10-24-84
ITR Number:	MEA309	MEA311	MEA319	MEA323	MEA322	MEA321	MEA315
INORGANIC COMPOUNDS							
ALUMINUM	5100	4100	4370	3400	3390	4421	6840
ARSENIC	6.5	7.2	[4.6]	[3.7]	[4.5]	5.5	15
BARIUM	[81]	[35]	[38]	[27]	[29]	[40]	[44]
BERYLLIUM							[.39]
CADMIUM	4.1						
CALCIUM	104000	107000	108000	107000	140000	119000	68800
CHROMIUM	15	11	13	9.6	10	9.8	17
COBALT	[8.5]	[6.6]	[9.9]	[7.1]	[6.8]	[6.5]	[6.5]
COPPER	18	18	23	19	21	18	24
IRON	15100	14300	16400	13200	13800	15100	20700
LEAD	6.5	7.2	7.1	4.5	5	7.1	17
MAGNESIUM	27400	28000	29500	24800	28700	30200	21300
MANGANESE	555 *	334 *	337 *	285 *	405 *	309 *	390
NICKEL	[20]	15	[19]	[13]	[15]	[16]	[18]
POTASSIUM	[1490]	[1620]	[1630]	[1240]	[1280]	[1590]	[1190]
SILVER							
SODIUM	[673]	[958]	[1430]	[983]	[1100]	[1210]	[1190]
TIN							
VANADIUM	[19]	[15]	[17]	[16]	[15]	[15]	[22]
ZINC	47	56	44	54	[38]	41	65
PERCENT SOLIDS	92%	90%	91%	93%	92%	91%	84%

FOOTNOTES:

E- Value is estimated or not reported due to the presence of interference.
*- Duplicate analysis is not within control limits.
+- Correlation coefficient for method of standard addition is less than 0.995.
[]- Positive values less than the contract required detection limit.

NOTE: CONCENTRATIONS REPORTED ON A DRY WEIGHT BASIS

Sampling locations are presented in Figures 4-1 (Phase 1 sampling) and 4-2 (Phase 2 sampling).

Background Concentrations. General standards are not established for inorganic metal concentrations in soil. Therefore, metal concentrations reported for soil samples from the site are compared with typical concentration ranges and estimated background levels for these inorganic constituents to determine if contamination is present.

Onsite background inorganic concentrations were estimated using eight Phase 2 soil samples. Results of organic analysis indicated that organic contaminants were either not present or present only in relatively minor concentrations in these samples. Therefore, these eight samples were considered least affected by waste handling operations at the site and selected to estimate background levels.

For each inorganic constituent, the mean concentration, standard deviation, and the 95 percent confidence interval of the mean was calculated using the analytical results from the eight selected soil samples. These background values are presented in Table 4-4.

Also, shown in Table 4-4 are typical concentration ranges for inorganic constituents in soil. These published ranges were developed from concentration measurements in soil sampled throughout the United States.

Inorganic Contamination. Inorganics most frequently exceeding the comparison criteria include cadmium, chromium, copper, lead, and zinc. Other less frequently exceeding inorganic constituents include aluminum, arsenic, barium, cobalt, iron, manganese, nickel, and vanadium. Figure 4-3 summarizes the distribution of inorganic constituents exceeding the upper 95 percent confidence limits of background concentrations. Figure 4-4 summarizes the distribution of inorganic constituents exceeding typical concentrations in soil.

Observations regarding the comparison of the inorganic analysis results with estimated onsite background values for soil are:

- The largest variety of inorganics constituents exceeding background values are reported in shallow (0-3 feet) soil samples.
- The number and frequency of inorganic constituents exceeding background values decreases with depth.
- Inorganic constituents that represent the most widespread exceedance of background values are chromium, copper, lead, and zinc.

Table 4-4
TYPICAL AND BACKGROUND CONCENTRATIONS OF METALS IN SOIL (mg/kg)

		Onsite Background Soil Values[a]					
		Observed Range in Background Samples	Mean	Standard Deviation	Upper 95 percent Confidence Interval of the mean	Typical Range[b] in Soil	Concentration[c] Range in Soil
Aluminum	Al	4,100 - 10,600	6,151	2,594	12,290	--	10,000 - 300,000
Antimony	Sb	<25 - 42	-	-	-	2 - 10	0.2 - 150
Arsenic	As	4.6 - 17	7.6	3.9	16.8	1 - 50	0.1 - 194
Barium	Ba	33 - 81	5.3	18.7	97.2	100 - 3,000	100 - 3,000
Beryllium	Be	<0.3 - 0.67	-	-	-	0.1 - 40	0.1 - 40
Cadmium	Cd	<2 - 4.1	-	-	-	0.01 - 0.7	0.01 - 7
Chromium	Cr	11 - 15	13	2	17.7	1 - 1,000	5 - 3,000
Cobalt	Co	5.8 - 14	8.4	2.6	14.6	1 - 40	0.05 - 65
Copper	Cu	18 - 30	21.5	4.0	31.0	2 - 100	2 - 250
Cyanide	Cn	Less than 0.5	Less than 0.5	-	-	--	--
Iron	Fe	14,000 - 27,000	17,950	4,754	29,190	--	100 - 550,000
Lead	Pb	6.7 - 15	9.5	3.1	16.8	2 - 200	<1 - 888
Manganese	Mn	109 - 555	369	131	679	20 - 3,000	20 - 18,300
Mercury	Hg	Less than 0.05	Less than 0.05	-	-	0.01 - 0.3	0.01 - 4.6
Nickel	Ni	15 - 37	21.2	7.0	37.8	5 - 500	0.1 - 1,530
Selenium	Se	Less than 2.5	Less than 2.5	-	-	0.1 - 2.0	0.1 - 38
Silver	Ag	Less than 2.5	Less than 2.5	-	-	0.01 - 5	0.01 - 8
Thallium	Tl	Less than 3.0	Less than 3.0	-	-	--	0.1 - 0.8
Tin	Sn	Less than 14	Less than 14	-	-	2 - 200	1 - 200
Vanadium	V	17 - 35	21.4	7.6	39.4	20 - 500	3 - 500
Zinc	Zn	44 - 90	60.9	16.6	100	10 - 300	1 - 2,000

Notes:

[a]Onsite soil samples used to estimate background soil values are: SB01 (5.5-7 ft), SB02 (5.5-7 ft), SB04 (5-6.5 ft), TP-1 (1-1.5 ft), TP-1 (4-5 ft), TP-2 (1-2.5 ft), TP-9 (3-5 ft), TP-11 (3-5 ft).
[b]Source: W.L. Linday, Chemical Equilibrium in Soils, 1979.
[c]Sources: H.J. M. Bowen, Environmental Chemistry of the Elements, 1979; URE, A.M., et al., Environmental Chemistry, 1983; Parr, J.F., Marsh, P.B., KLa, J.M., Land Treatment of Hazardous Wastes, 1983.

GLT360/69

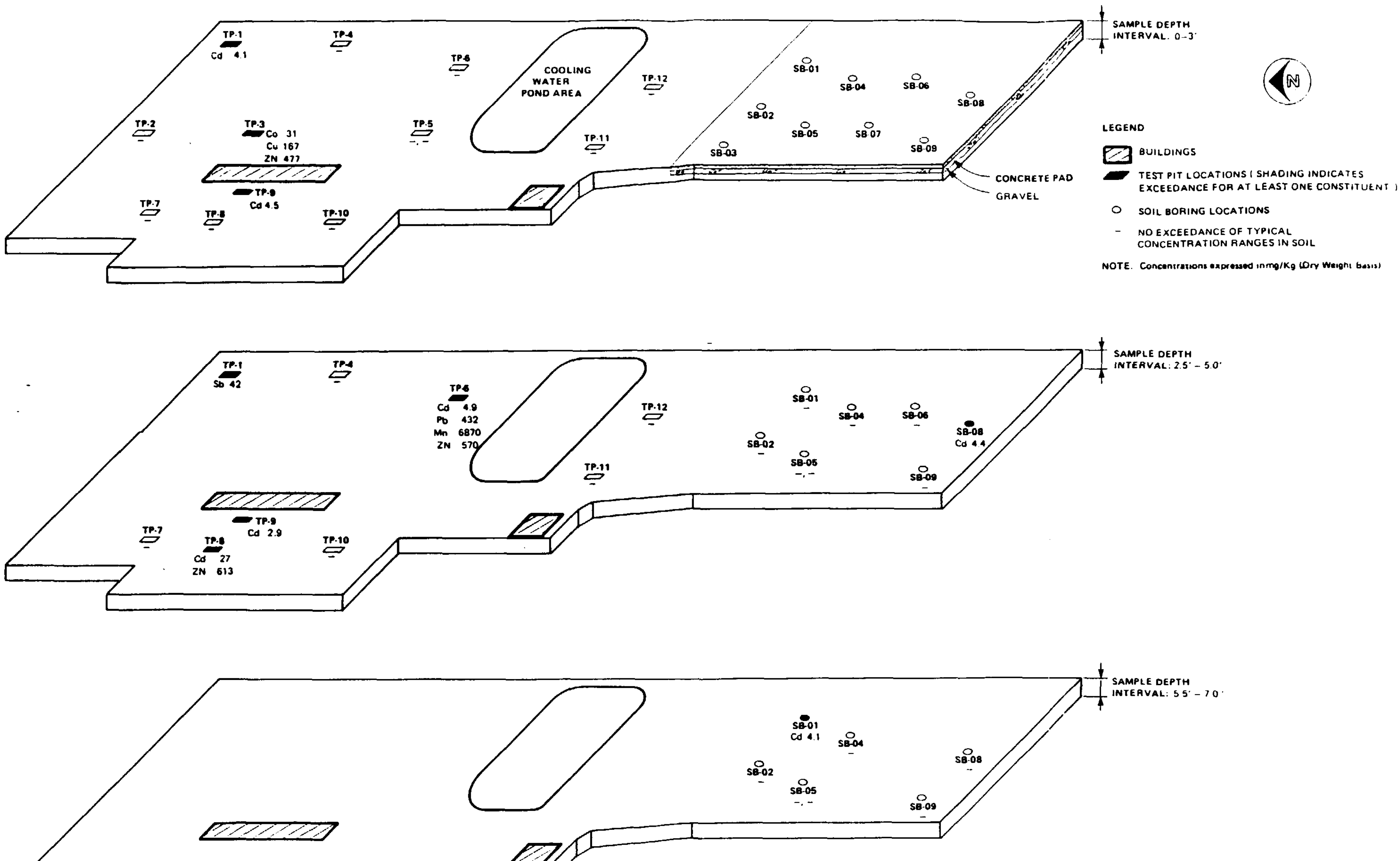


FIGURE 4-4
INORGANIC CONSTITUENT CONCENTRATIONS EXCEEDING TYPICAL CONCENTRATION RANGES IN SOIL
ECC RI

- Inorganic constituent exceedance of background values in soil beneath the concrete pad is minor relative to the soil in the northern drum and tank storage areas.

Observations regarding the comparison of inorganic analysis results with typical ranges for soil are:

- Only antimony, cadmium, cobalt, copper, lead, manganese, and zinc were reported in soil samples at concentrations exceeding the typical range in soil.

- Only cadmium, lead, and zinc were reported in more than one sample at concentrations exceeding the typical range in soil.

- Inorganic constituent exceedance of the typical ranges in soil for samples beneath the concrete pad is minor relative to the soil in the northern drum and tank storage areas.

Organic Compounds

Soil samples collected during the Phase 1 and 2 sampling activities were analyzed for volatile organics, acid extractable, base/neutral extractable, pesticide, and PCB compounds using the CLP. Analytical results are presented in Tables 4-5 through 4-8.

Background Concentrations. General standards are not established for organic compound concentrations in soil. Therefore, organic compound concentrations reported for soil samples from the site are compared with background concentrations to determine if contamination is present. Many of the organic compounds analyzed for during this RI are not naturally occurring compounds and their presence indicates the influence of man's activities on the soil. Also, analysis of several soil samples from the site did not detect any priority pollutant organic compounds or other organic compounds on the CLP's hazardous substances list. Therefore, this RI report considers the detection of organic compounds in soil samples analyzed for by the CLP's routine analytical services as evidence of contamination.

Organic Contamination, Phase 1 Sampling. Analysis of soil samples collected during Phase 1 sampling activities detected a wide variety of organic contaminants. Organic contaminants included volatile organic, acid extractable, base/neutral extractable, and pesticide compounds. PCB's were detected in only one Phase 1 soil sample.

The specific compounds detected, their maximum reported concentration, and general occurrence onsite are summarized in

TABLE 4-5
SOIL ORGANIC RESULTS (ug/kg)
PHASE I SAMPLING
ECC Site RI Report

	SURFACE SOIL SAMPLES FROM NORTH AND NORTHWEST EMBANKMENTS							SURFACE SOIL SAMPLES					SOIL BORING SAMPLES				
Sample Location:	AA	AC	AE	AG	AI	AK	AL	AM-SW	AO-SE	AP-SE	N OF P	N OF PD	AN	AE-AH	AE-AG	B-6	D-7
Depth (ft):	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5			0-0.5	0-0.5	0-0.5	0-0.5	1.5-2
Date Sampled:	5-8-84	5-8-84	5-8-84	5-8-84	5-8-84	5-8-84	5-8-84	5-9-84	5-8-84	5-8-84	5-9-84	5-9-84	5-9-84	5-9-84	5-9-84	5-8-84	5-8-84
DTR Number:	E-7244	E-7245	E-7246	E-7247	E-7248	E-7249	E-7250	E-7255	E-7251	E-7252	E-7253	E-7254	E-7256	E-7257	E-7258	E-7259	E-7260
VOLATILE COMPOUNDS																	
1, 2-DICHLOROETHANE									280								
1, 1, 1-TRICHLOROETHANE								676000	17500	193500	7411400	4510000	40	40000	270000	1203200	635000
1, 1-DICHLOROETHANE										700			60				
CHLOROFORM									580	890			20			41800	17600
TRANS-1, 2-DICHLOROETHENE								34400	79700	1500			100			41800	
CIS-1, 3-DICHLOROPROPENE															12000		
ETHYLBENZENE								262000	600		121200	514000		9000	5645000	155000	120000
METHYLENE CHLORIDE	80	10	10	20	20	50	50	515000	2400	2500	141800	120000	10	34000	35000	65500	94000
CHLOROMETHANE	70																
TETRACHLOROETHENE								4116000	570	4600	617200	625000		131000	238000	630000	744100
TOLUENE								751000	14800		687100	674000		80000	273000	470700	964000
TRICHLOROETHENE							2 K	4214000	1800	2800	6000200	2006000	60	147000	664000	2135700	1375000
VINYL CHLORIDE									6400								
ACETONE									30300								
2-BUTANONE									5200							99200	89600
4-METHYL-2-PENTANONE									730		2600 K	2200 K				7600	29600
STYRENE														5000	19000		13800
TOTAL XYLENES								1160000	15000		707000	345000		97000	633000	882600	607000
TOTAL VOLATILES	150	10	10	20	20	50	52	11728400	175860	206490	15769300	8796200	290	551000	7793000	5733100	4689700
ACID COMPOUNDS																	
2, 4-DIMETHYLPHENOL								36000				88000 K					
PHENOL								18000 K	7200		367600	447000		24500	138000	114000	119000
BENZOIC ACID									11000 K				1600 K	28200 K			
2-METHYLPHENOL								93100			61300 K	142600		20800	28900 K	130000	23000
4-METHYLPHENOL								52000			87900 K	535600		67800	36700 K	518000	31000
TOTAL ACIDS	0	0	0	0	0	0	0	199100	18200	0	516000	1213200	1600	141300	203600	754000	173000
BASE/NEUTRAL COMPOUNDS																	
1, 2, 4-TRICHLOROBENZENE											389600	49000					119000
1, 2-DICHLOROBENZENE								15900 K	31500		534100	333700		84100	252700	2160000	172000
1, 4-DICHLOROBENZENE									33700		570000						
1, 2-DIPHENYLHYDRAZINE								68600 K								4000 K	
HEXACHLOROBUTADIENE									5000								
ISOPHORONE						40		41900 K	970		409200	44000 K		41700	59300	340000	122000
NAPHTHALENE								30300 K	1500		298300	55700 K		26100	400000	470000	99000
NITROBENZENE									7800								
N-NITROSODIMETHYLAMINE									9900								
N-NITROSODIPHENYLAMINE				40	1400												
N-NITROSODIPROPLYAMINE									12000								
BIS(2-ETHYLHEXYL)PHTHALATE	230	40		40 K	80 K			755200	48300		774600	685900		291900	458100	3800000	226000
BENZYL BUTYL PHTHALATE								1282000	42500		200900	366000	970 K	85000	268000	1000000	61000
DI-N-BUTYL PHTHALATE								67900				79000		14300	112200		11000
DI-N-OCTYL PHTHALATE	10 K							127800	8300	17000 K	78600 K	84000		8900	22600 K	300000	34000
DIETHYL PHTHALATE												35000 K					
DIMETHYL PHTHALATE															25400		
PHENANTHRENE														4600			8000
2-METHYLNAPHTHALENE								7200 K			104000	44900 K		8800 K	55100	130000	31000
TOTAL B/N's	240	40	0	80	1400	40	0	2396800	201470	17000	3359300	1777200	970	565400	1661400	8204000	883000

NOTE: CONCENTRATIONS REPORTED ON A DRY WEIGHT BASIS -- SAMPLES ANALYZED FOR ROUTINE ORGANIC PACKAGE, BUT ONLY DETECTED COMPOUNDS ARE LISTED -- FOOTNOTES GIVEN ON FOLLOWING PAGE

TABLE 4-5
SOIL ORGANIC RESULTS (ug/kg)
PHASE I SAMPLING
EDC Site RI Report

	SURFACE SOIL SAMPLES FROM NORTH AND NORTHWEST EMBANKMENTS							SURFACE SOIL SAMPLES					SOIL BORING SAMPLES				
Sample Location:	AA	AC	AE	AG	AI	AK	AL	AM-SW	AO-SE	AP-SE	N OF P	N OF PD	AN	AE-AH	AE-AG	B-6	D-7
Depth (ft):	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5			0-0.5	0-0.5	0-0.5	0-0.5	1.5-2
Date Sampled:	5-8-84	5-8-84	5-8-84	5-8-84	5-8-84	5-8-84	5-8-84	5-9-84	5-8-84	5-8-84	5-9-84	5-9-84	5-9-84	5-9-84	5-9-84	5-8-84	5-8-84
OTR Number:	E-7244	E-7245	E-7246	E-7247	E-7248	E-7249	E-7250	E-7255	E-7251	E-7252	E-7253	E-7254	E-7256	E-7257	E-7258	E-7259	E-7260
PESTICIDES																	
DELTA-BHC												760			260	170	540
GAMMA-BHC (LINDANE)																170	
HEPTACHLOR													10	90	90	210	
ALDRIN															20		
ENDOSULFAN I										40	8300						
DIELDRIN						10		450		140	20	20					700
4, 4-DDE											830	720		100	110	160	
ENDRIN										190	10000			670			11200
ENDOSULFAN II												6300			110		11100
4, 4-DDD															1000		5900
ENDRIN ALDEHYDE											12100	9400					28000
ENDOSULFAN SULFATE											4000	3300					19000
4, 4-DDT	70									500	28900	21000	40	1300	2000	3200	36000
METHOXYCHLOR																	
CHLORDANE											2700	2300					
TOXAPHENE											10000						
TOTAL PESTICIDES	70	0	0	0	0	10	0	450	0	870	77650	43800	50	2160	4470	3910	104440
PCB's																	
AROCHLOR-1016											10800						
AROCHLOR-1232											16200						
AROCHLOR-1248											10800						
TOTAL PCB's	0	0	0	0	0	0	0	0	0	0	37800	0	0	0	0	0	0
DIOXIN																	
2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN																7.6	6.1
PERCENT MOISTURE	14.6%	14.1%	13.8%	11.3%	11.4%	12%	11.8%	16.9%	15.5%	14.2%	48.1%	38.5%	16.9%	13.5%	15%	29.2%	21.6%

FOOTNOTES:
A. Tentatively identified compound concentrations are estimated. A 1:1 response is assumed.
B. Analyte has been found in the laboratory blank as well as the sample. Indicates probable contamination.
C. Applies to pesticide parameters where the identicication has been confirmed by GC/MS.
J. Indicates an estimated value. When mass spectral data indicates the presence of a compound that meets the identification criteria and the result is less than the specified detection limit but greater than zero.
K. Actual value, within the limitations of the method is less than the value given

NOTE: CONCENTRATIONS REPORTED ON A DRY WEIGHT BASIS — SAMPLES ANALYZED FOR ROUTINE ORGANIC PACKAGE, BUT ONLY DETECTED COMPOUNDS ARE LISTED —

PHASE II

TABLE 4-6
SOIL ORGANIC RESULTS (ug/kg)
TEST PITS
SHALLOW DEPTH SAMPLES
ECC Site RI Report

Sample Location:	TP-1	TP-2	TP-3	TP-4	TP-5	TP-5	TP-6	TP-6	TP-7	TP-8	TP-9	TP-10	TP-11	TP-12
Depth (ft):	1-1.5	1-1.5	1-1.5	1-2	1-2	2-3	1-2	2-3	1-2.5	1-2.5	1-3	1-3	1-3	1-3
Date Sampled:	10-22-84	10-22-84	10-22-84	10-22-84	10-22-84	10-22-84	10-22-84	10-22-84	10-23-84	10-24-84	10-24-84	10-24-84	10-24-84	10-24-84
OTR Number:	E4901	E4903	E4904	E4905	E4907	E4908	E4909	E4910	E4916	E4918	E4920	E4922	E4924	E4926
VOLATILE COMPOUNDS														
CHLOROBENZENE				360										
1, 1, 1-TRICHLOROETHANE			5400				1100000				130000			6400
1, 1, 2-TRICHLOROETHANE														550
1, 1-DICHLOROETHENE							35000 B							240
TRANS-1, 2-DICHLOROETHENE					79		120000 B					9		
ETHYLBENZENE				2800		21 B	560000		21000		1500000			
METHYLENE CHLORIDE	93 B	28 B	2800 B	820 B	260 B		140000 B	250 B	2900	53	310000	76	130	1600
TETRACHLOROETHENE	9 J		2900	570			650000		1100		74000	8		290
TOLUENE			1600		88	6	1100000		27000		2000000			1200
TRICHLOROETHENE			3400 B	280 B	580		4000000 B		6000	14	150000	15		410
VINYL CHLORIDE														
ACETONE			50000 B	39000 B	7600	62		8900	17000		650000			12000
2-BUTANONE			37000 B	33000 B	13000	150		13000	24000		2800000			12000
4-METHYL-2-PENTANONE			4600	2500	990	52		300	12000		190000			
TOTAL XYLENES				18000			2000000		120000		6800000			
TOTAL VOC's	102	28	107700	97330	22597	291	10585000	22450	231000	67	14604000	108	130	34690
ACID COMPOUNDS														
PHENOL							570000							
2-METHYLPHENOL														
4-METHYLPHENOL							53000							
TOTAL ACIDS	0	0	0	0	0	0	623000	0	0	0	0	0	0	0
BASE/NEUTRAL COMPOUNDS														
1, 2-DICHLOROBENZENE	1600			2400			900000	240	36000	3800				
ISOPHORONE	270 J		1100		1700		440000			470		850		340
NAPHTHALENE				1800			180000		60000	710	78000			
BIS(2-ETHYLHEXYL)PHTHALATE	15000			5700			370000	1200	61000	6300	59000	27000		
BUTYL BENZYL PHTHALATE	1500								47000	3500		950		
DI-N-BUTYL PHTHALATE				690					8200			900		
DI-N-OCTYL PHTHALATE	2100			1500						340				
DIMETHYL PHTHALATE														
FLUORENE														
PHENANTHRENE				450							8100			
2-METHYLNAPHTHALENE				2100										
TOTAL B/N COMPOUNDS	20470	0	1100	14640	1700	0	1890000	1440	212200	15120	145100	29700	0	340
PCB's														
AROCHLOR-1232				340 C										
AROCHLOR-1260	970										39000	750		
TOTAL PCB's	970	0	0	340	0	0	0	0	0	0	39000	750	0	0

NOTE: CONCENTRATIONS ARE REPORTED ON A DRY WEIGHT BASIS -- SAMPLES ANALYZED FOR ROUTINE ORGANIC PACKAGE, BUT ONLY DETECTED COMPOUNDS ARE LISTED -- FOOTNOTES GIVEN ON FOLLOWING PAGE

TABLE 4-6
SOIL ORGANIC RESULTS (ug/kg)
TEST PITS
SHALLOW DEPTH SAMPLES
ECC Site RI Report

Sample Location:	TP-1	TP-2	TP-3	TP-4	TP-5	TP-5	TP-6	TP-6	TP-7	TP-8	TP-9	TP-10	TP-11	TP-12
Depth (ft):	1-1.5	1-1.5	1-1.5	1-2	1-2	2-3	1-2	2-3	1-2.5	1-2.5	1-3	1-3	1-3	1-3
Date Sampled:	10-22-84	10-22-84	10-22-84	10-22-84	10-22-84	10-22-84	10-22-84	10-22-84	10-23-84	10-24-84	10-24-84	10-24-84	10-24-84	10-24-84
QTR Number:	E4901	E4903	E4904	E4905	E4907	E4908	E4909	E4910	E4916	E4918	E4920	E4922	E4924	E4926
TENTATIVELY IDENTIFIED COMPOUNDS	A													
ETHYLBENZENE									37000					
UNDECANE				20000					75000					
4-METHYL-4-HYDROXYL-2-PENTANONE														
NONANE														
DECANE				20000			400000			5900				
ETHYLBENZENE			600							12000	270000			
ETHYL-METHYL-BENZENE														
TRIDECANE				10000						24000	270000			
PENTADECANE										35000				
HEXADECANE				20000				2000		9500				
HEPTADECANE				10000						12000				
OCTADECANE											140000			
SULFUR														
TOLUENE										47000	680000			4700
4-METHYL-2-PENTANONE										4700				
TETRACHLOROETHENE										24000				
PHTHALATE										9500				
BUTYL CELLOSOLVE														
t-BUTYL ALCOHOL												60		
PHENYL ETHER												12000		
2,6-BIS(1,1-DIMETHYLETHYL)-2,5-CYCLOHEXADIENE-1,4-DIONE												1200		
2,6-BIS(1,1-DIMETHYLETHYL)-4-METHYLPHENOL												47000		
3,3,5-TRIMETHYLCYCLOHEXANONE				10000	1000			3000						
1,1,2,2-TETRACHLOROETHANE														
PENTANOIC ACID														
HEXANOIC ACID														
DIETHYL ETHER														800
4-HYDROXY-4-METHYL-2-PENTANONE														2400
2-BUTANOL														
NONADECANE											270000			
PHTHALIC ACID	1000						500000							
TOLUENE-2, 4-DIISOCYANATE	5000													
2, 4-DIMETHYL-3-PENTANONE			600											
TETRADECANE				10000										
DODECANE							800000							
1-METHYL-2-PYRROLIDINONE								7000						
LAURIC ACID								1000						
PERCENT MOISTURE	19.2	15.0	11.1	16.0	10.4	8.7	19.0	13.5	19.8	15.4	26.0	15.1	13.8	10.3

FOOTNOTES:
A. Tentatively identified compound concentrations are estimated. A 1:1 response is assumed.
B. Analyte has been found in the laboratory blank as well as the sample. Indicates probable contamination.
C. Applies to pesticide parameters where the identicication has been confirmed by GC/MS.
J. Indicates an estimated value. When mass spectral data indicates the presence of a compound that meets the identification criteria and the result is less than the specified detection limit but greater than zero.
K. Actual value, within the limitations of the method is less than the value given

TABLE 4-7
SOIL ORGANIC RESULTS (ug/kg)
TEST PITS
INTERMEDIATE DEPTH SAMPLES
ECC Site RI Report

Sample Location: Depth (ft): Date Sampled: OTR Number:	TP-1 4-5 10-22-84 E4902	TP-4 2.5-3.5 10-22-84 E4906	TP-6 4-5 10-22-84 E4911	TP-7 2.5-4 10-23-84 E4917	TP-8 2.5-4 10-24-84 E4919	TP-9 3-5 10-24-84 E4921	TP-10 3-5 10-24-84 E4923	TP-11 A 3-5 10-24-84 E4925	TP-12 3-5 10-24-84 E4927
VOLATILE COMPOUNDS									
CHLOROBENZENE									
1, 1, 1-TRICHLOROETHANE					7700				1900
1, 1, 2-TRICHLOROETHANE									62
1, 1-DICHLOROETHENE									47
TRANS-1, 2-DICHLOROETHENE									9
ETHYLBENZENE				20000	10000		14		
METHYLENE CHLORIDE	17	16 B	16	4400	1900	110	59	67	82
TETRACHLOROETHENE				26000	29000				
TOLUENE				10000	19000		13		120
TRICHLOROETHENE				1000	66000	13	6		86
VINYL CHLORIDE						7			
ACETONE				53000	41000				590
2-BUTANONE				64000	87000				630
4-METHYL-2-PENTANONE					13000				83
TOTAL XYLENES				100000	41000				
TOTAL VOC's	0	16	16	279200	315600	130	92	67	3609
ACID COMPOUNDS									
PHENOL					25000				
2-METHYLPHENOL							340		
4-METHYLPHENOL									
TOTAL ACIDS	0	0	0	0	25000	0	340	0	0
BASE/NEUTRAL COMPOUNDS									
1, 2-DICHLOROBENZENE		4400	2400	890	76000				
ISOPHORONE					17000				
NAPHTHALENE		2100		640	12000				
BIS(2-ETHYLHEXYL)PHTHALATE		7700	2600	680	25000				
BUTYL BENZYL PHTHALATE			540		5900				
DI-N-BUTYL PHTHALATE					3900				
DI-N-OCTYL PHTHALATE									
DIMETHYL PHTHALATE					1300				
FLUORENE				260					
PHENANTHRENE				350	650				
2-METHYLNAPHTHALENE				1900					
TOTAL B/N's	0	14200	5540	4720	141750	0	0	0	0
PCB's									
AROCHLOR-1232		540 C							
AROCHLOR-1260					1700				
TOTAL PCB's	0	540	0	0	1700	0	0	0	0

NOTE: CONCENTRATIONS REPORTED ON A DRY WEIGHT BASIS — SAMPLES ANALYZED FOR ROUTINE ORGANIC PACKAGE, BUT ONLY DETECTED COMPOUNDS ARE LISTED — FOOTNOTES GIVEN ON FOLLOWING PAGE

TABLE 4-7
SOIL ORGANIC RESULTS (ug/kg)
TEST PITS
INTERMEDIATE DEPTH SAMPLES
ECC Site RI Report

Sample Location:	TP-1	TP-4	TP-6	TP-7	TP-8	TP-9	TP-10	TP-11	TP-12
Depth (ft):	4-5	2.5-3.5	4-5	2.5-4	2.5-4	3-5	3-5	A 3-5	3-5
Date Sampled:	10-22-84	10-22-84	10-22-84	10-23-84	10-24-84	10-24-84	10-24-84	10-24-84	10-24-84
OTR Number:	E4902	E4906	E4911	E4917	E4919	E4921	E4923	E4925	E4927
TENTATIVELY IDENTIFIED COMPOUNDS	A								
ETHYLBENZENE									
UNDECANE		20000		4700	34000				
4-METHYL-4-HYDROXYL-2-PENTANONE				5900					
NONANE				2400	90000				
DECANE		30000			45000				
ETHYLBENZENE				1200					
ETHYL-METHYL-BENZENE									
TRIDECANE				5900					
PENTADECANE				9400	11000				
HEXADECANE		20000	2000						
HEPTADECANE		10000		5900	22000				
OCTADECANE				6000					
SULFUR				3500			2400		
TOLUENE				2400			35000		
4-METHYL-2-PENTANONE					67000				
TETRACHLOROETHENE					220000			800	
PHTHALATE									
BUTYL CELLOSOLVE					34000				
t-BUTYL ALCOHOL							80		
PHENYL ETHER									
2,6-BIS(1,1-DIMETHYLETHYL)-2,5-CYCLOHEXADIENE-1,4-DIONE									
2,6-BIS(1,1-DIMETHYLETHYL)-4-METHYLPHENOL									
3,3,5-TRIMETHYLCYCLOHEXANONE							240		
1,1,2,2-TETRACHLOROETHANE							900		
PENTANOIC ACID							2400		
HEXANOIC ACID							4700		
DIETHYL ETHER									
4-HYDROXY-4-METHYL-2-PENTANONE									
2-BUTANOL									
NONADECANE		9000							
PHTHALIC ACID									
TOLUENE-2, 4-DIISOCYANATE									
2, 4-DIMETHYL-3-PENTANONE									
TETRADECANE									
DODECANE		10000							
1-METHYL-2-PYRROLIDINONE									
LAURIC ACID									
PERCENT MOISTURE	12.2	11.5	17.1	15.0	10.8	9.2	15.3	16.3	10.7

FOOTNOTES:
A. Tentatively identified compound concentrations are estimated. A 1:1 response is assumed.
B. Analyte has been found in the laboratory blank as well as the sample. Indicates probable contamination.
C. Applies to pesticide parameters where the identicication has been confirmed by GC/MS.
J. Indicates an estimated value. When mass spectral data indicates the presence of a compound that meets the identification criteria and the result is less than the specified detection limit but greater than zero.
K. Actual value, within the limitations of the method is less than the value given

NOTE: CONCENTRATIONS REPORTED ON A DRY WEIGHT BASIS -- SAMPLES ANALYZED FOR ROUTINE ORGANIC PACKAGE, BUT ONLY DETECTED COMPOUNDS ARE LISTED --

TABLE 4-8
SOIL BORING ORGANIC RESULTS (ug/kg)
ECC Site RI Report

	INTERMEDIATE BORINGS								DEEP BORINGS				
Sample Location:	SB-01	SB-02	SB-03*	SB-03*	SB-04	SB-06	SB-08	SB-09	SB0104	SB0204	SB0403	SB0805	SB0904
Depth (ft):	2.5-4	2.5-4	2.5-4	2.5-4	2-3.5	2-3.5	2.5-4	2.5-4	5.5-7	5.5-7	5-6.5	7-8.5	5.7-7
Date Sampled:	10-24-84	10-24-84	10-24-84	10-24-84	10-24-84	10-24-84	10-24-84	10-24-84	10-24-84	10-24-84	10-24-84	10-24-84	10-24-84
OTR Number:	E4912	E4914	E4928	E4929	E4934	E4932	E4931	E8077	E4913	E4915	E4933	E4935	E4930
VOLATILE COMPOUNDS													
1,1,1-TRICHLOROETHANE	14	49000	11000	65	3 J	27000	27 J	18000				11	110
1,1-DICHLOROETHANE								300 J					
1,1,2-TRICHLOROETHANE			150		14								
CHLOROFORM	57	2900										5 J	
1,1-DICHLOROETHENE		1600											
TRANS-1,2-DICHLOROETHENE	37	1500			17		72					41	29
ETHYLBENZENE	15	21000				4800	27 J						
METHYLENE CHLORIDE	100 B	10000 B	1900	74	8	4100	59 B	1050	27 B	34 B	33	54	190
TETRACHLOROETHENE	44	11000			5 J	10000	26 J					8	
TOLUENE	52	31000	600			11000	170	20000	21	10		14	120
TRICHLOROETHENE	39	60000	340			110000	16 J	640				3 J	76
ACETONE	1400		32000	550	16	17000	380 B	10000	66		18 B	41 B	6500
2-BUTANONE	1200	17000	24000	550	6 J	8000 JB	410 B	6600 B					1000
2-HEXANONE					70		1600	920					
4-METHYL-2-PENTANONE	250			36			35 J						44
TOTAL XYLENES	95	110000			36	21000	190	2800				11	
TOTAL VOC's	3303	12900	70070	1275	175	220900	3012	60390	27	34	51	180	8069
ACID COMPOUNDS													
PHENOL						610		1100					
2-METHYLPHENOL													
4-METHYLPHENOL													
TOTAL ACIDS	0	0	0	0	0	610	0	1100	0	0	0	0	0
BASE/NEUTRAL COMPOUNDS													
ISOPHORONE						500							
NAPHTHALENE		640											
BIS(2-ETHYLHEXYL)PHTHALATE	230						730					270 J	
BUTYL BENZYL PHTHALATE								400 J					
DI-N-BUTYL PHTHALATE					420 JB	400 JB	53	320 JB			310 B		
DIETHYL PHTHALATE		9000				1200							
DIMETHYL PHTHALATE		1200				360 J							
TOTAL B/N COMPOUNDS	230	10840	0	0	420	2460	783	720	0	0	0	0	0

NOTE: CONCENTRATIONS REPORTED ON A DRY WEIGHT BASIS — SAMPLES ANALYZED FOR ROUTINE ORGANIC PACKAGE BUT ONLY DETECTED COMPOUNDS ARE LISTED — FOOTNOTES GIVEN ON FOLLOWING PAGE

TABLE 4-8
SOIL BORING ORGANIC RESULTS (ug/kg)
ECC Site RI Report

	INTERMEDIATE BORINGS								DEEP BORINGS				
Sample Location:	SB-01	SB-02	SB-03*	SB-03*	SB-04	SB-06	SB-08	SB-09	SB0104	SB0204	SB0403	SB0805	SB0904
Depth (ft):	2.5-4	2.5-4	2.5-4	2.5-4	2-3.5	2-3.5	2.5-4	2.5-4	5.5-7	5.5-7	5-6.5	7-8.5	5.7-7
Date Sampled:	10-24-84	10-24-84	10-24-84	10-24-84	10-24-84	10-24-84	10-24-84	10-24-84	10-24-84	10-24-84	10-24-84	10-24-84	10-24-84
OTR Number:	E4912	E4914	E4928	E4929	E4934	E4932	E4931	E8077	E4913	E4915	E4933	E4935	E4930
PESTICIDE COMPOUNDS													
NONE DETECTED													
PCB's													
NONE DETECTED													
TENTATIVELY IDENTIFIED COMPOUNDS													
DECANE		900											
UNDECANE		1000											
TRICHLOROFLUOROMETHANE											10 J	12 J	
4-METHYL-2-PENTANOL					4 J								
TETRACHLOROETHENE					4 J								
1, 1, 2-TRICHLORO-1, 2, 2-TRIFLUOROETHANE								24000 J					
ISOPROPYL ALCOHOL				110 J									
2-BUTANOL				90 J									
DIETHYL ETHER													40 J
HEXANE													50
PERCENT MOISTURE	13.7	11.4	11.59	11.06	12	10	12	8	10.7		11	8	14.5

FOOTNOTES:
A. Tentatively identified compound concentrations are estimated. A 1:1 response is assumed.
B. Analyte has been found in the laboratory blank as well as the sample. Indicates probable contamination.
C. Applies to pesticide parameters where the identicication has been confirmed by GC/MS.
J. Indicates an estimated value. When mass spectral data indicates the presence of a compound that meets the identification criteria and the result is less than the specified detection limit but greater than zero.
K. Actual value, within the limitations of the method is less than the value given
* Duplicate samples were taken at SB-03

Table 4-9. Site cleanup activities completed after the Phase 1 sampling included soil removal from the northern drum storage area, capping of the site with berm soil, and general onsite soil disturbance associated with waste handling and removal. Surface cleanup activities have therefore removed and/or redistributed some portion of the soil sampled during the Phase 1 sampling. The information collected for analysis of Phase 1 samples is presented to indicate the types, concentrations, and general site location of organic contaminants once present in soil at the site.

Organic Contamination, Phase 2 Sampling. As with the Phase 1 samples, analysis of soil samples collected during Phase 2 sampling activities detected a wide variety of organic contaminants. Major compound groups detected included volatile organics, phenols, phthalates, polynuclear aromatic hydrocarbons (PAHs), and PCBs. Of these compound groups, volatile organics and phthalates were more commonly detected and generally were reported at the highest concentrations. Figures 4-5, 4-6, and 4-7 summarize the distribution of the major organic compound groups detected in Phase 2 soil samples.

Nineteen VOCs were detected in soil samples from the site. The primary VOC's detected in soil samples from the site include the following:

1,1,1-Trichloroethane	Methylene Chloride
Tetrachloroethene	Acetone
Trichloroethene	2-Butanone
Ethylbenzene	4-methyl-2-Pentanone
Toluene	Xylenes

Volatile organic compounds are the most widespread organic contaminant at the site and were detected to the maximum soil sampling depth of 8.5 feet. Except for areas near test pits 7 and 8 and below the concrete pad, total VOC concentration in subsurface soil (2.5-8.5 feet) are generally several orders-of-magnitude lower than observed in surface soil.

Phthalate compounds detected in soil samples at the site are:

Bis(2-ethylhexyl)phthalate	Di-n-octyl phthalate
Butyl Benzyl Phthalate	Diethyl Phthalate
Di-n-butyl Phthalate	Dimethyl Phthalate

The distribution of phthalate compounds is similar to that of the VOC's, except that phthalates are generally reported in lower concentrations and are not as frequently detected in subsurface soils. As with the VOC's, phthalate compound concentrations in subsurface soil are generally several orders-of-magnitude less than detected in surface soil.

Table 4-9
SUMMARY OF ORGANIC COMPOUNDS DETECTED IN PHASE 1 SOIL SAMPLES

		Site Areas Where Compoud was Detected in Phase 1 Samples		
	Maximum Observed Concentration (ug/kg)	Berm Area	Drum and Tank Storage Area North of the Cooling Water Pond	Soil Areas South of the Cooling Water Pond and Adjacent to the Concrete Pond
Volatiles				
1,2-Dichlorethane	280			X
1,1,-Trichlorethane	7,411,400		X	X
1,1-Dichloroethane	700			X
Chloroform	41,800		X	X
Trans-1,2-Dichloroethene	79,700		X	X
Cis-1,2-Dichlorepropane	12,000			X
Ethylbenzene	5,649,000		X	X
Methylene Chloride	515,000	X	X	X
Chloromethane	70	X		
Tetrachloroethene	4,116,000		X	X
Toluene	954,000		X	X
Trichloroethene	6,080,200		X	X
Vinyl Chloride	6,400			X
Acetone	30,300			X
2-Butanone	99,200		X	X
4-metyl-2-Pentanone	29,600		X	X
Styrene	19,000		X	X
Total Xylenes	1,160,000		X	X
Acid Extractable Compounds				
2,2-Diemthyl phenol	88,000			X
Phenol	447,000		X	X
Benzoic Acid	28,200		X	X
2-Methyl Phenol	142,600		X	X
4-Methyl Phenol	535,600		X	X

Table 4-9 (Continued)

	Maximum Observed Concentration (ug/kg)	Site Areas Where Compoud was Detected in Phase 1 Samples		
		Berm Area	Drum and Tank Storage Area North of the Cooling Water Pond	Soil Areas South of the Cooling Water Pond and Adjacent to the Concrete Pond
Base/Neutral Extractable				
1,2,4-Trichlorobenzene	389,600			
1,2-Dichlorobenze	2,160,000		X	X
1,4-Dichloroe benzene	570,000			X
1,2-Diphenylhydrazine	68,600K		X	X
Hexachloroebutadiene	5,000			X
Isophorone	409,200		X	X
Naphthalene	470,000		X	X
Nitrobenzene	7,800			X
N-Nitrosodimethyamine	9,900			X
N-Nitrosodiphenylamine	1,400	X		
N-Nitrosodipropylamine	12,000			X
Bis(2-ethylhexyl)phthalate	3,800,000	X	X	X
Benzyl Butyl Phthalate	1,282,000		X	X
Di-N-Butyl Phthalate	112,200		X	X
Di-N-Octyl Phthalate	300,000		X	X
Dicthyl Phthalate	3,500			X
Dimethyl Phthalate	25,400		X	
Phenanthrene Phthalate	8,000		X	
2-Methylnapthalene	130,000		X	X
Pesticides				
Delta-BHC	760		X	X
Gamma-BHC (lindane)	170		X	
Heptachlor	210		X	
Aldrin	20		X	
Dieldrin	700	X	X	X
Endrin	11,200		X	X
Endosulfan I	8,300			X
Endosulfan II	11,100		X	X
4,4-DDD	5,900		X	
4,4-DDE	830		X	X
4,4-DDT	36,000	X	X	X

Table 4-9 (Continued)

	Maximum Observed Concentration (ug/kg)	Site Areas Where Compoud was Detected in Phase 1 Samples: Berm Area	Drum and Tank Storage Area North of the Cooling Water Pond	Soil Areas South of the Cooling Water Pond and Adjacent to the Concrete Pond
Pesticides (Continued)				
Endrin Aldehyde	20,000		X	X
Endosulfan Sulfate	19,000		X	X
Chlordane	2,700			X
Toxaphene	10,800			X
PCB's				
Arochlor-1016	10,800			X
Arochlor-1232	16,200			X
Arochlor-1248	10,800			X

GLT360/72

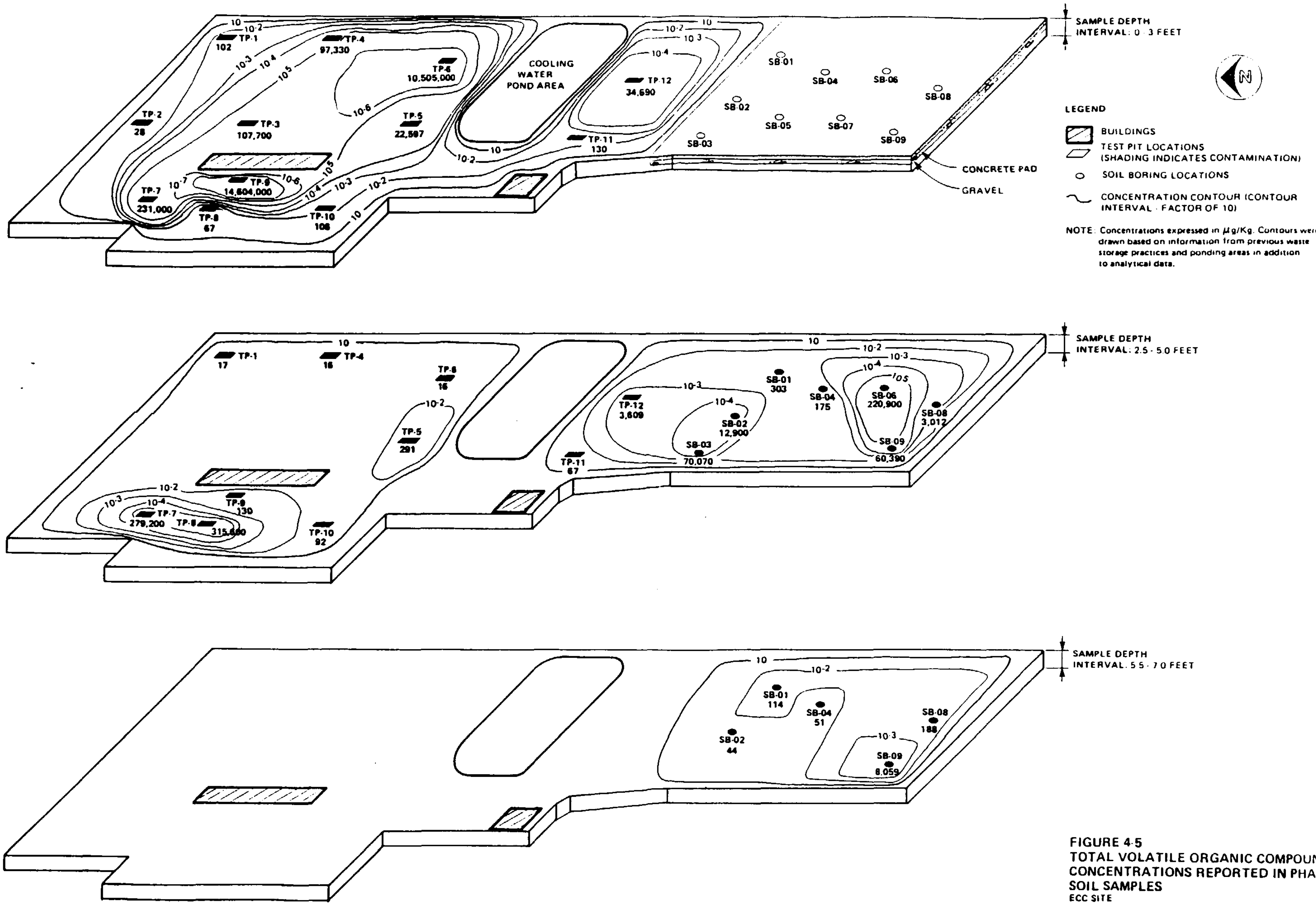


FIGURE 4-5
TOTAL VOLATILE ORGANIC COMPOUND CONCENTRATIONS REPORTED IN PHASE 2 SOIL SAMPLES
ECC SITE

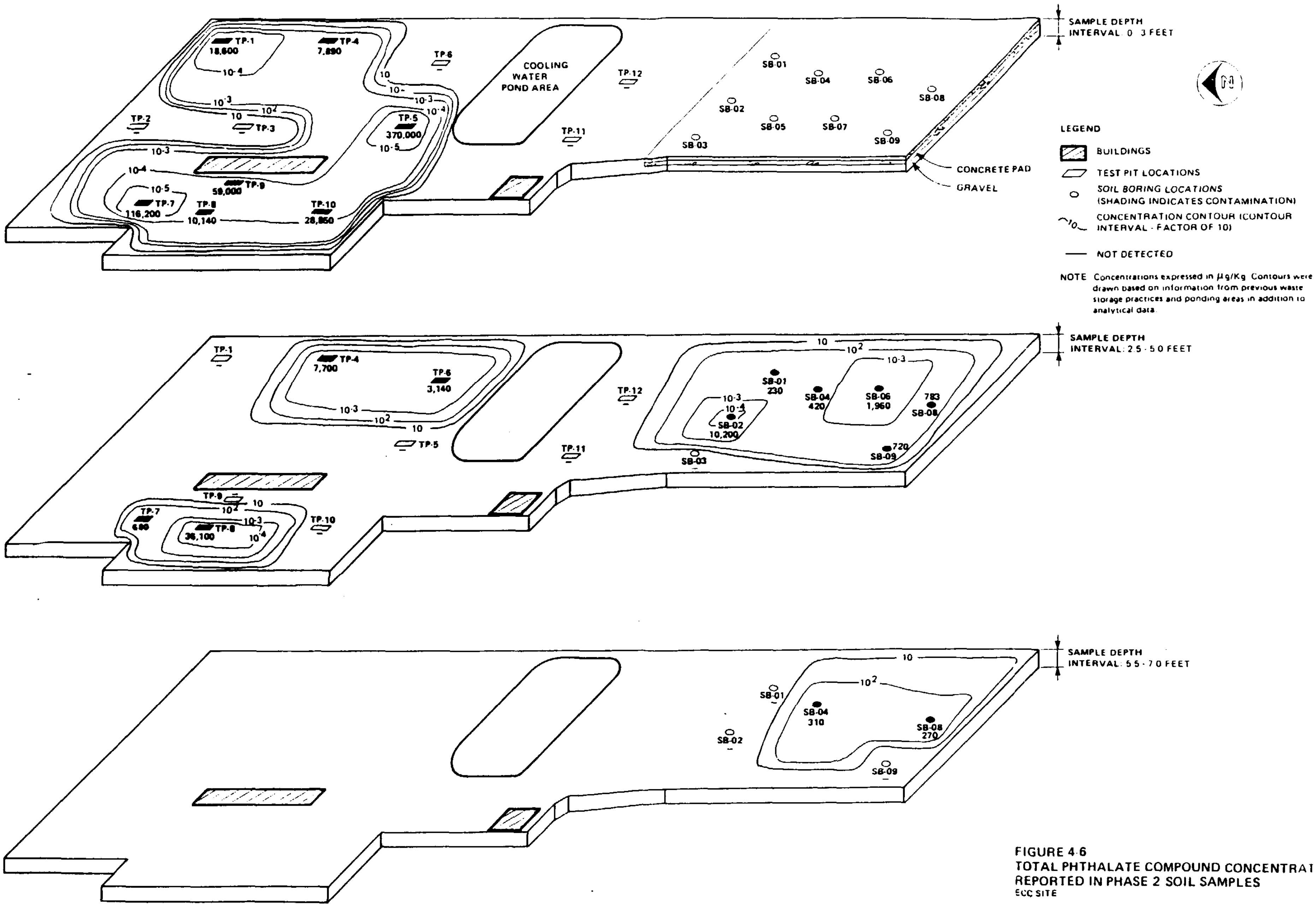


FIGURE 4-6
TOTAL PHTHALATE COMPOUND CONCENTRATIONS
REPORTED IN PHASE 2 SOIL SAMPLES
ECC SITE

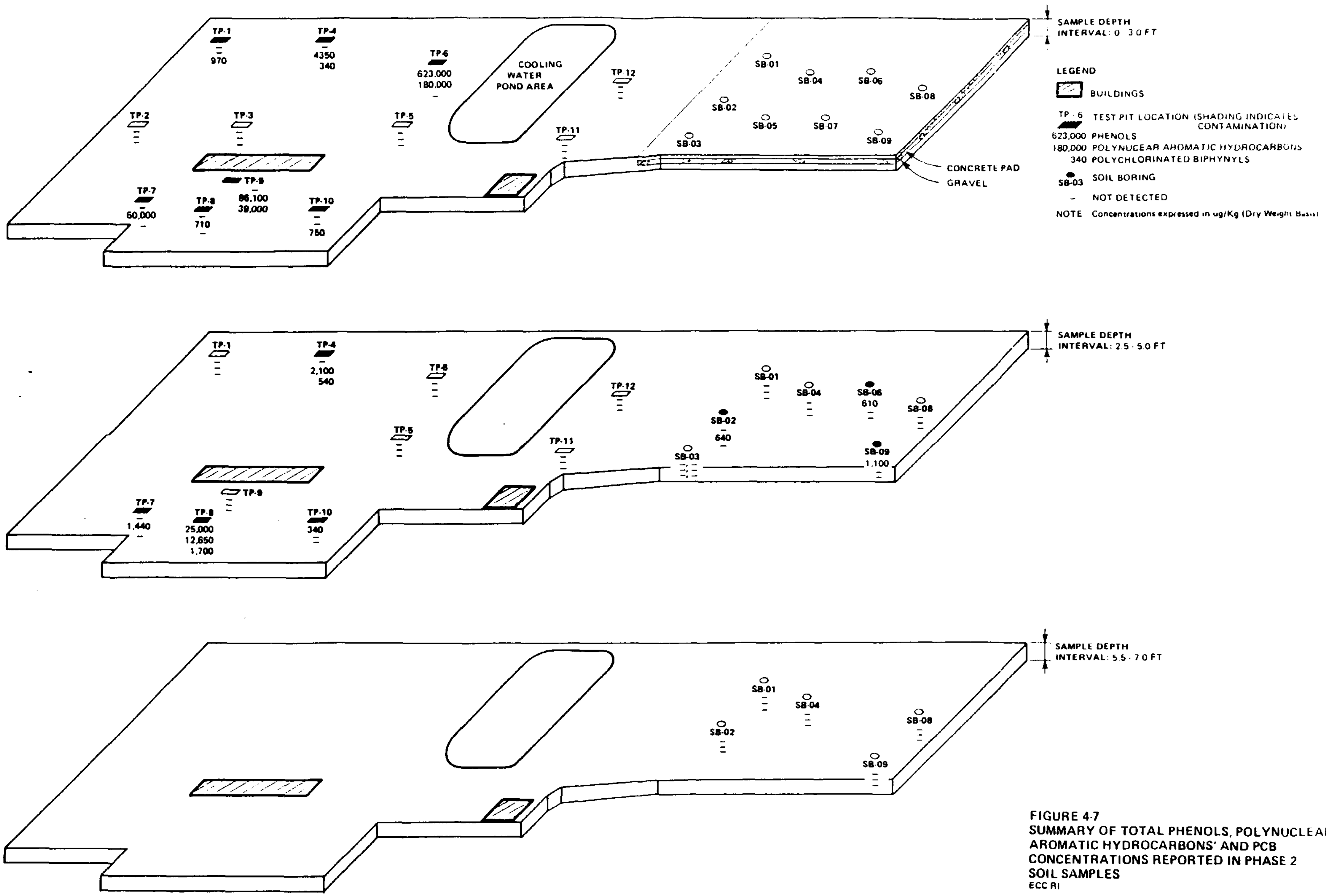


FIGURE 4-7
SUMMARY OF TOTAL PHENOLS, POLYNUCLEAR AROMATIC HYDROCARBONS' AND PCB CONCENTRATIONS REPORTED IN PHASE 2 SOIL SAMPLES
ECC RI

Acid extractable compounds detected in soil from the site are:

2,4-Dimethyphenol	Phenol
2-Methylphenol	Benzoic Acid
4-Methylphenol	

Phenol was the most frequently detected of these compounds. Contamination of soil with these compounds appears to be limited to localized areas; surface soil in the vicinity of test pit 6; surface soil adjacent to the concrete pad; subsurface soil in the vicinity of test pit 8; and subsurface soil beneath the concrete pad.

PAH's detected in soil at the site are:

Napthalene
Fluorene
Phenanthrene
3-Methylnaphthalene

Naphthalene is the most frequently detected PAH and the only PAH detected in soil samples from beneath the concrete pad. The detection of PAH compounds is, except for one sample, limited to surface soil adjacent to the concrete pad and soil in the northern drum and tank storage areas.

PCB's were detected in only six Phase 2 soil samples. Their detection was limited to soil sampled in the northern drum and tank storage areas. The maximum concentration reported was 39,000 ug/kg, but concentrations were generally less than 1,000 ug/kg.

CONCLUSIONS AND OBSERVATIONS

Inorganic contamination of the soil is apparently greatest in the near surface (0-3 feet) soil in northern portions of the site. Inorganic contamination does appear to extend to depths of at least 5 feet in the northern portions of the site, although it is less widespread than observed in the overlying shallow soil.

General observations regarding the organic contamination at the site are:

- Primary organic contaminants at the site are VOC's and phthalates. These compound groups are the most widespread organic contaminants and are generally present in the highest concentrations.

- Organic contamination decreases in the variety of compounds and their associated concentrations with depth. However, organic contaminants were detected to the maximum depth of sample analysis (8.5 feet).

HYDROGEOLOGIC INVESTIGATIONS

Boone County, Indiana, is in a physiographic unit known as the Tipton Till Plain, a nearly flat to gently rolling glacial plain, which is the result of continental ice sheets that covered the county about 20,000 years ago. During the period, known as the Pleistocene Epoch, large quantities of earth materials were deposited upon the bedrock surface, with a maximum thickness approaching 350 feet. The major aquifers in Boone County are in sand and gravel deposits of glacial origin. These deposits are also important sources of aggregate materials.

The bedrock formations beneath the glacial drift in Boone County consist of limestones and dolomites of Silurian and Devonian age and shales of Devonian and Mississippian age. The beds generally dip about 10 to 30 feet per mile to the southwest toward the Illinois Basin.

SCOPE AND METHODS

A hydrogeologic investigation was conducted to define the soil stratigraphy, characterize aquifer conditions and determine groundwater flow directions, gradients, seasonal water level variations in the vicinity of the ECC site, and to define subsurface contaminant migration and pathways. The program included an electrical resistivity survey, test drilling with soil sampling and rock coring, installation of monitoring wells and sampling of groundwater. Details on methods and results are presented in TM 3-1 and 3-2 of Appendix A.

Electrical Resistivity Survey

An electrical resistivity survey was conducted to investigate the presence and lateral continuity of shallow sand and gravel deposits and the presence of fine-grained glacial tills in the vicinity of the ECC site. A secondary objective was to investigate the presence of a groundwater contaminant plume. Due to the presence of many surface features that may interfere with electrical resistivity, vertical electrical soundings were taken at each of 52 stations surrounding the site.

Test Drilling

A series of monitoring well clusters were installed around the ECC site using hollow stem augers and/or rotary techniques. The wells were classified into three groups based on their relative borehole depths. Eleven shallow boreholes (wells) were drilled to a maximum depth of about 30 feet (designated "A"). One intermediate borehole (well) was drilled to approximately 100 feet (designated "B"). Four deep boreholes (wells) were drilled into the top of rock, approximately 155 to 165 feet (designated "C"). Borehole locations are shown in Figure 4-8. Continuous split-spoon samples were taken at 2 foot intervals in the upper 20 to 30 feet in one borehole at each cluster and at 5 foot intervals thereafter to top of rock. The boreholes were drilled in three phases. Phase 1 included boreholes 1A, 1C, 2A, 2B, 2C, 3A, 3C, 4A, 4C, and 5A. Phase 2 included 6A and 7A which replaced 4A due to a drilling contamination problem. Phase 3 included 8A, 9A, 10A, and 11A.

Laboratory testing included index tests for soil identification and classification. These consisted of Atterberg limits, moisture contents and mechanical grain size analysis. Samples were selected for testing after visual classification of all samples from a borehole and were selected on the basis of being representative of soil types encountered.

Monitoring Well Installation

A total of 16 2-inch diameter PVC monitoring wells were installed in the boreholes discussed above. Wells were developed either by flushing with clean water or by air lifting. The deep and intermediate wells (1C, 2B, 2C, 3C, and 4C) were free flowing and a packer assembly was devised to control the well water flow.

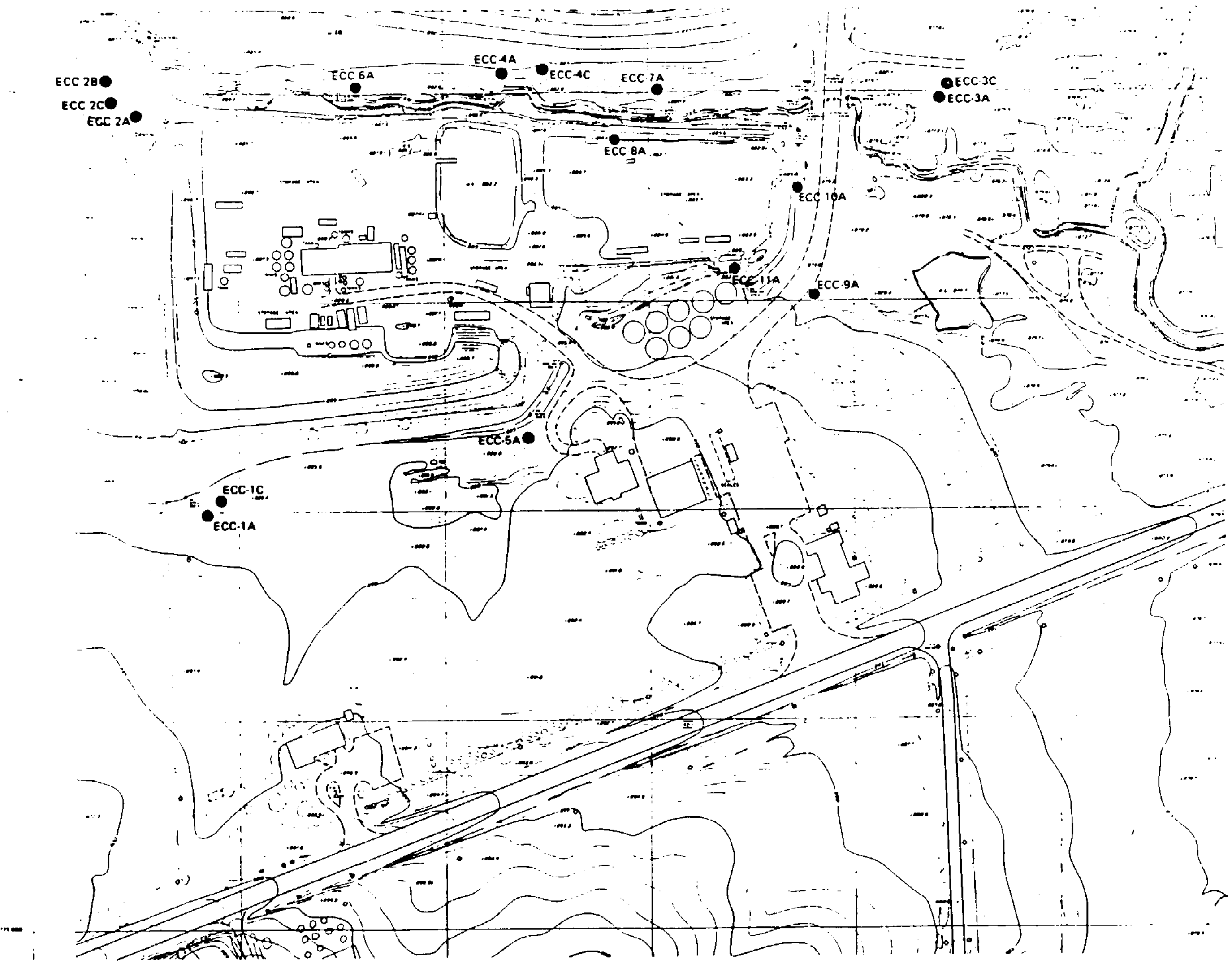
Monitoring Well Sampling

Monitoring wells were sampled in three phases. Phase 1, (July 18 and 19, 1983) included sampling of 1A, 1C, 2A, 2B, 2C, 3A, 3C, 4C, and 5A. Phase 2 (November 29 and 30, 1983) sampling included wells 1A, 1C, 2A, 2B, 2C, 3A, 3C, 5A, 6A, and 7A. Phase 3 (December 12 and 13, 1984) sampling included 1A, 2A, 3A, 5A, 6A, 7A, 8A, 9A, 10A, and 11A. The deep and intermediate wells were purged and sampled by opening the check valve in the packer assembly. The shallow wells were purged and sampled with a submersible stainless steel pump. Samples for VOC analysis were obtained with a stainless steel bailer. At least three well volumes were purged from each well prior to sampling. Samples for inorganic analysis were filtered in the field through a 0.45 micron filter and then preserved with nitric acid.

Water levels were taken using an electric well sounder. In the flowing deep and intermediate wells, 1¼ inch PVC pipe extensions were added to the packer assembly until the potentiometric surface was obtained.

Residential Well Sampling

Five residential wells were sampled on May 10, 1983. Wells were pumped for 20 to 30 minutes prior to sampling. Samples



LEGEND

● REMEDIAL INVESTIGATION MONITORING WELL
ECC-7A

NOTE. All well locations are approximate

N

0 100 200
50 150
SCALE IN FEET

FIGURE 4-8
MONITORING WELL LOCATIONS
ECC RI REPORT

were collected by filling the bottles directly from the faucet closest to the well head. Inorganic samples were not field filtered prior to preservation with nitric acid.

RESULTS

Site Geology

Soil types encountered at ECC from the ground surface to the top of rock consist of glacial tills, glacial outwash and possibly some shallow alluvial deposits. Figure 4-9 illustrates soil types for the four deep borings. The glacial till deposits, consisting predominantly of clayey silt and silty clay, formed the thickest sequence encountered. They appear to be highly overconsolidated based on Atterberg limits and relatively low permeability. Sands and gravels were found at nearly all boring locations. These consist of fine to coarse sand and gravel that are highly permeable. Some alluvial deposits occur near the ground surface, especially near the southeast corner of the ECC site and generally consist of fine sand and silty sand. Cross sections were prepared illustrating shallow soil conditions at the site (see Figure 4-10). Cross sections are presented in Figures 4-11, 4-12, and 4-13. Included are some of the borings completed previously at NSL. The shallow soil stratigraphy appears to be very complex near the south end of the ECC site. This is probably due to the combination of till, outwash and alluvial deposits present in this area.

Hydrogeologic Units

Four hydrogeologic units occur at different elevations beneath the site. The upper three units are illustrated in the stratigraphic column shown in Figure 4-14. These are:

- A shallow saturated zone consisting of clayey silts and silty clays approximately 5 to 15 feet below ground surface. The lithology of this unit is areally heterogeneous.
- A sand and gravel zone, approximately 15 to 30 feet below ground surface, that may be semiconfined in places.
- A thick zone of clayey silts and silty clays, approximately 30 to 150 feet below ground surface. This unit appears to act as an aquitard.
- A deep confined aquifer consisting of sand and gravel, approximately 150 to 165 feet below ground surface.

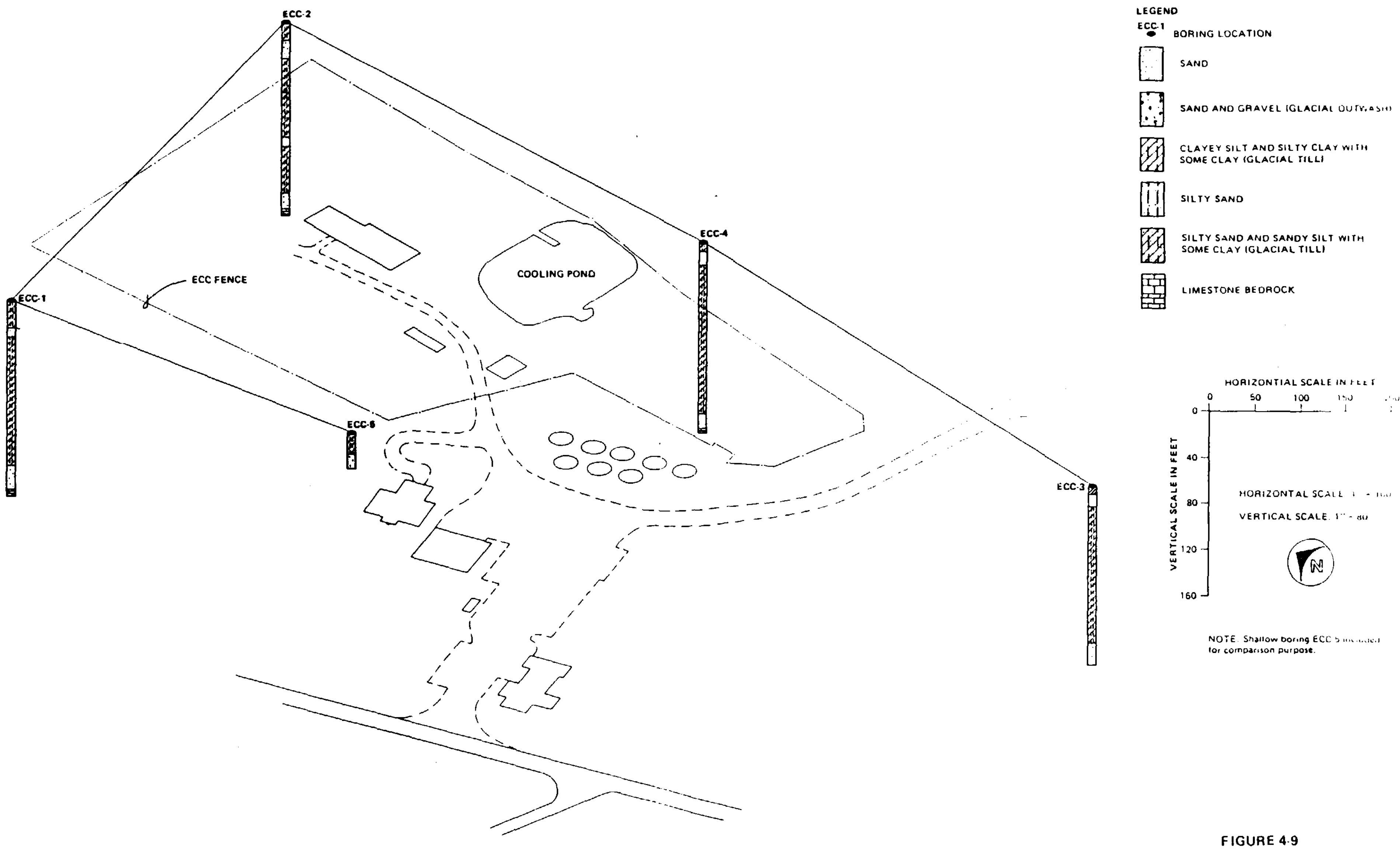


FIGURE 4-9
ISOMETRIC PROJECTIONS
OF DEEP BORINGS
ECC REPORT

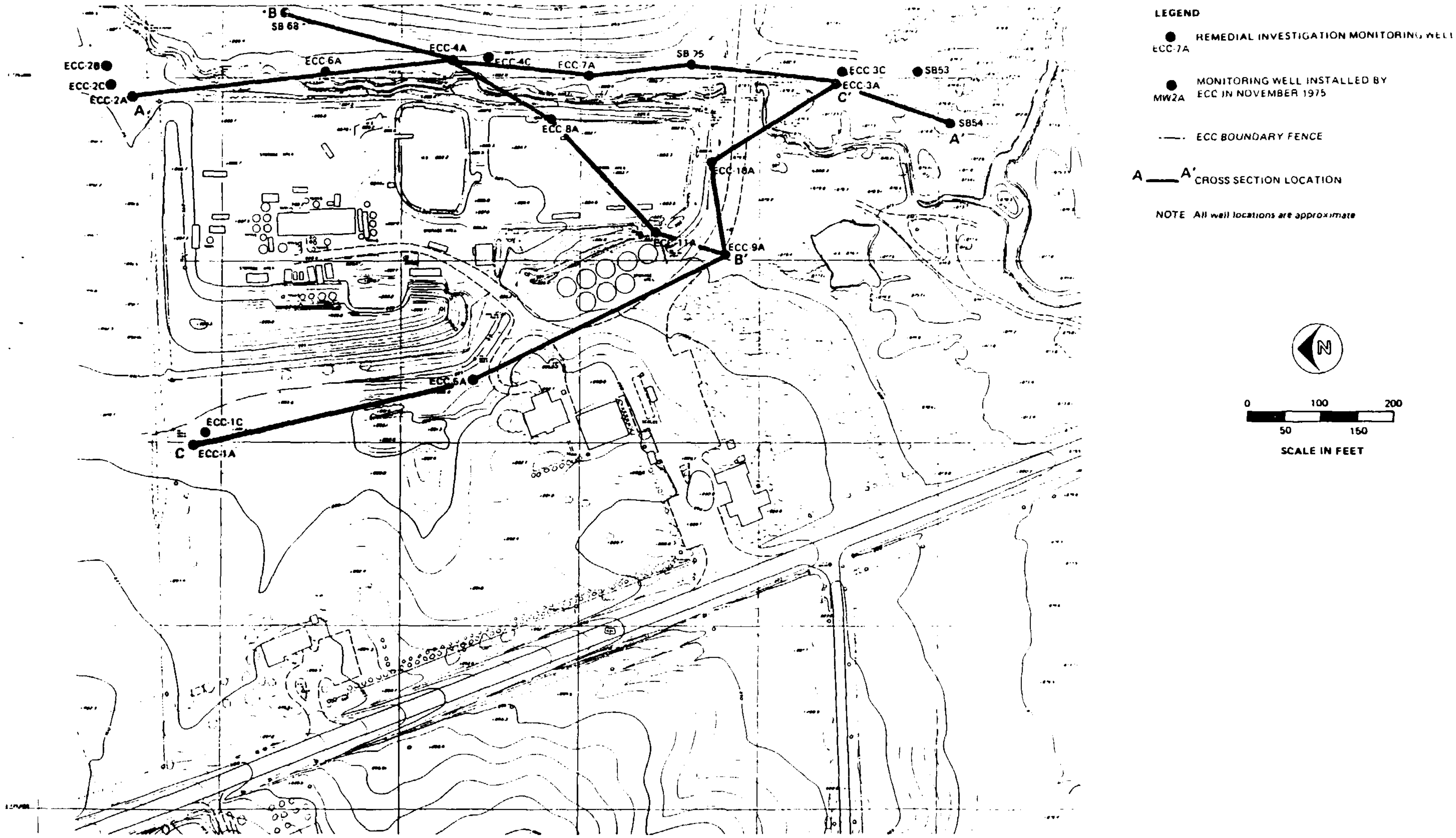


FIGURE 4-10
SOIL BORING CROSS
SECTION LOCATIONS
ECC RI

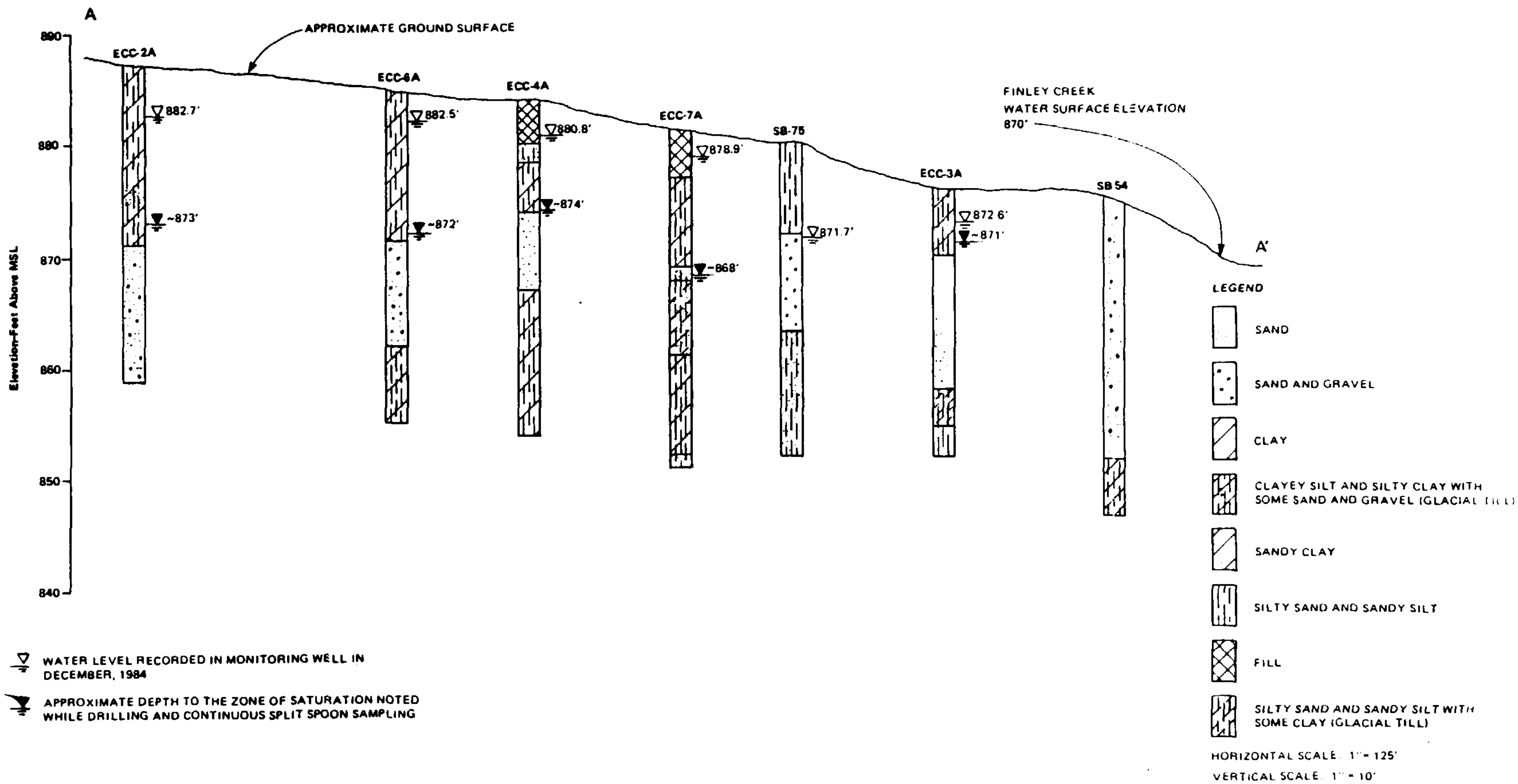


FIGURE 4-11
CROSS SECTION A-A'
ALONG THE UNNAMED DITCH
ECC RI

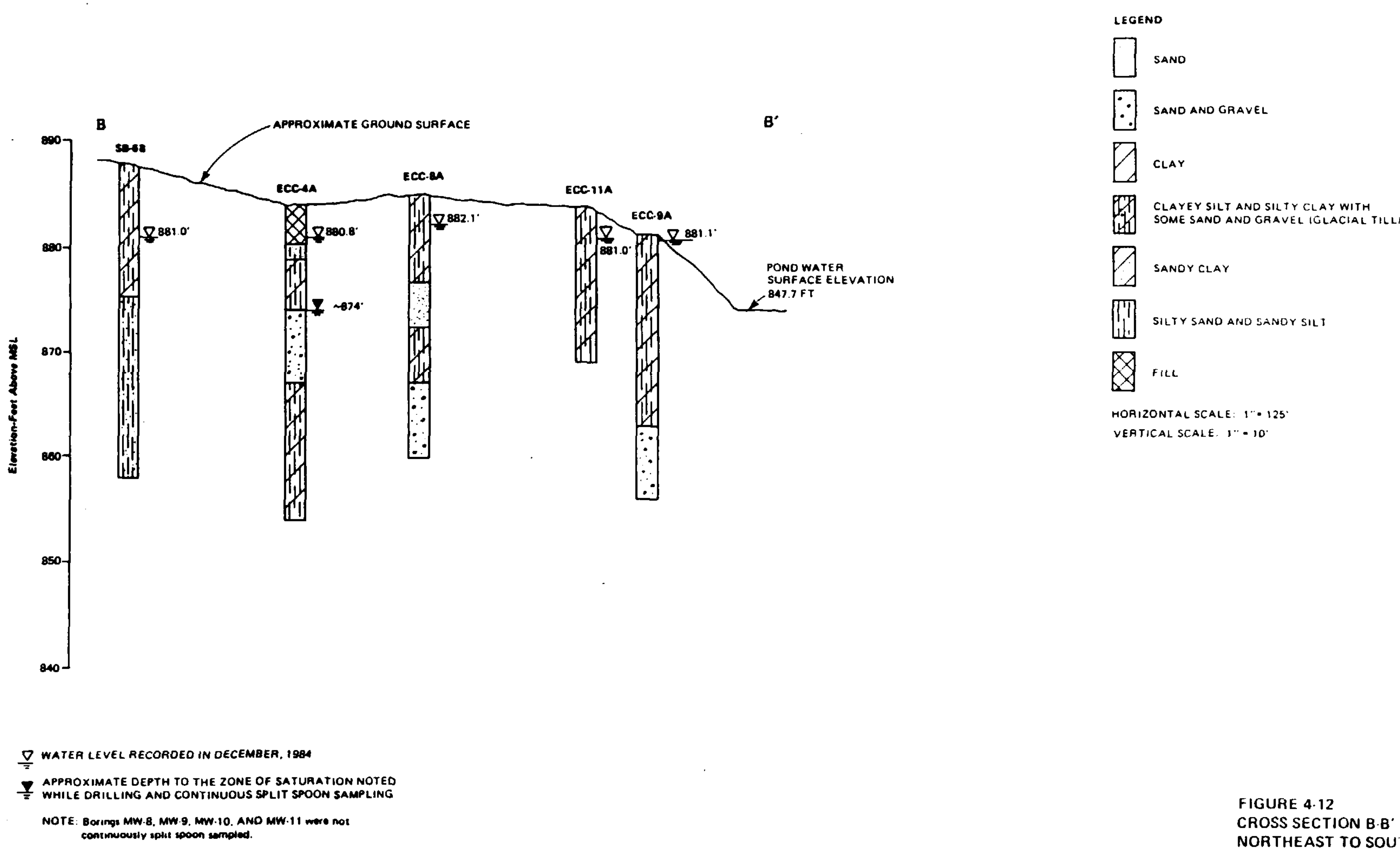
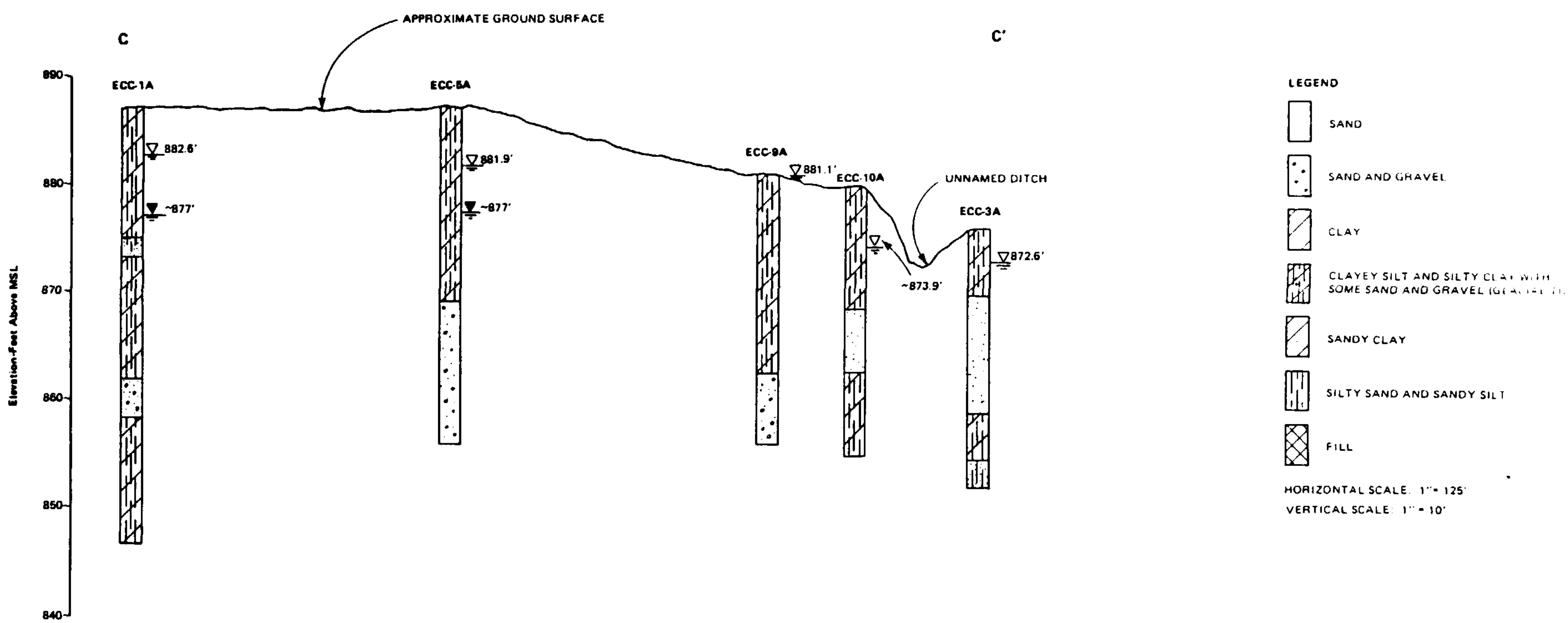


FIGURE 4-12
CROSS SECTION B-B'
NORTHEAST TO SOUTHWEST
ACROSS SITE
ECC RI

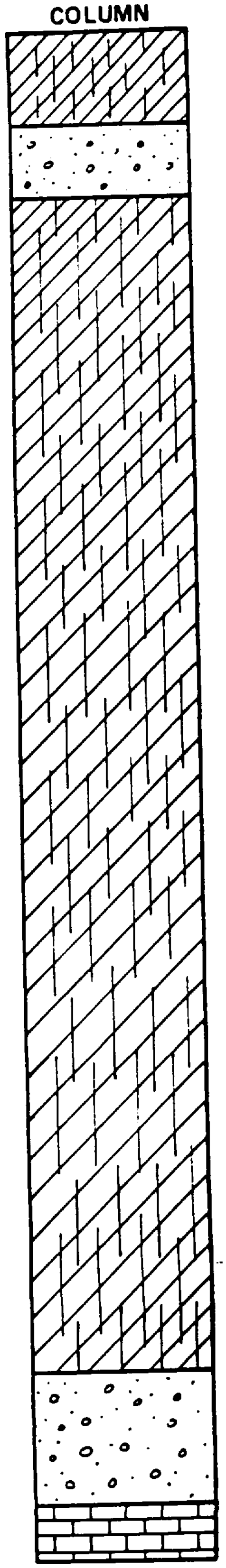


WATER LEVEL RECORDED IN THE MONITORING WELL SCREENED IN THE SHALLOW SAND AND GRAVEL ZONE IN DECEMBER, 1984.

APPROXIMATE DEPTH TO THE ZONE OF SATURATION NOTED WHILE DRILLING AND CONTINUOUS SPLIT SPOON SAMPLING

NOTE: Borings MW-8, MW-9, MW-10, AND MW-11 were not continuously split spoon sampled.

FIGURE 4-13
CROSS SECTION C-C'
NORTHWEST TO SOUTHEAST
ACROSS SITE
ECC RI



GENERALIZED STRATIGRAPHIC COLUMN	THICKNESS RANGE	GEOLOGIC LOG	HYDROGEOLOGIC LOG
	5-25'	GLACIAL TILL, CLAYEY SILTS AND SILTY CLAYS. OCCASIONAL LENSES OF SAND AND GRAVEL	GLACIAL TILL - SHALLOW SATURATED ZONE. LOCALLY CONFINING
	3-20'	SAND AND GRAVEL OUTWASH DEPOSITS WITH SILT LENSES	SHALLOW SAND AND GRAVEL ZONE. WATER BEARING UNIT.
	120-130'	GLACIAL TILL - CLAYEY SILTS AND SILTY CLAYS	GLACIAL TILL WATER RETARDING UNIT
	10-25'	SAND AND GRAVEL OUTWASH DEPOSITS	DEEP CONFINED AQUIFER
		LIMESTONE BEDROCK	

FIGURE 4-14
GENERALIZED STRATIGRAPHIC COLUMN
ECC RI

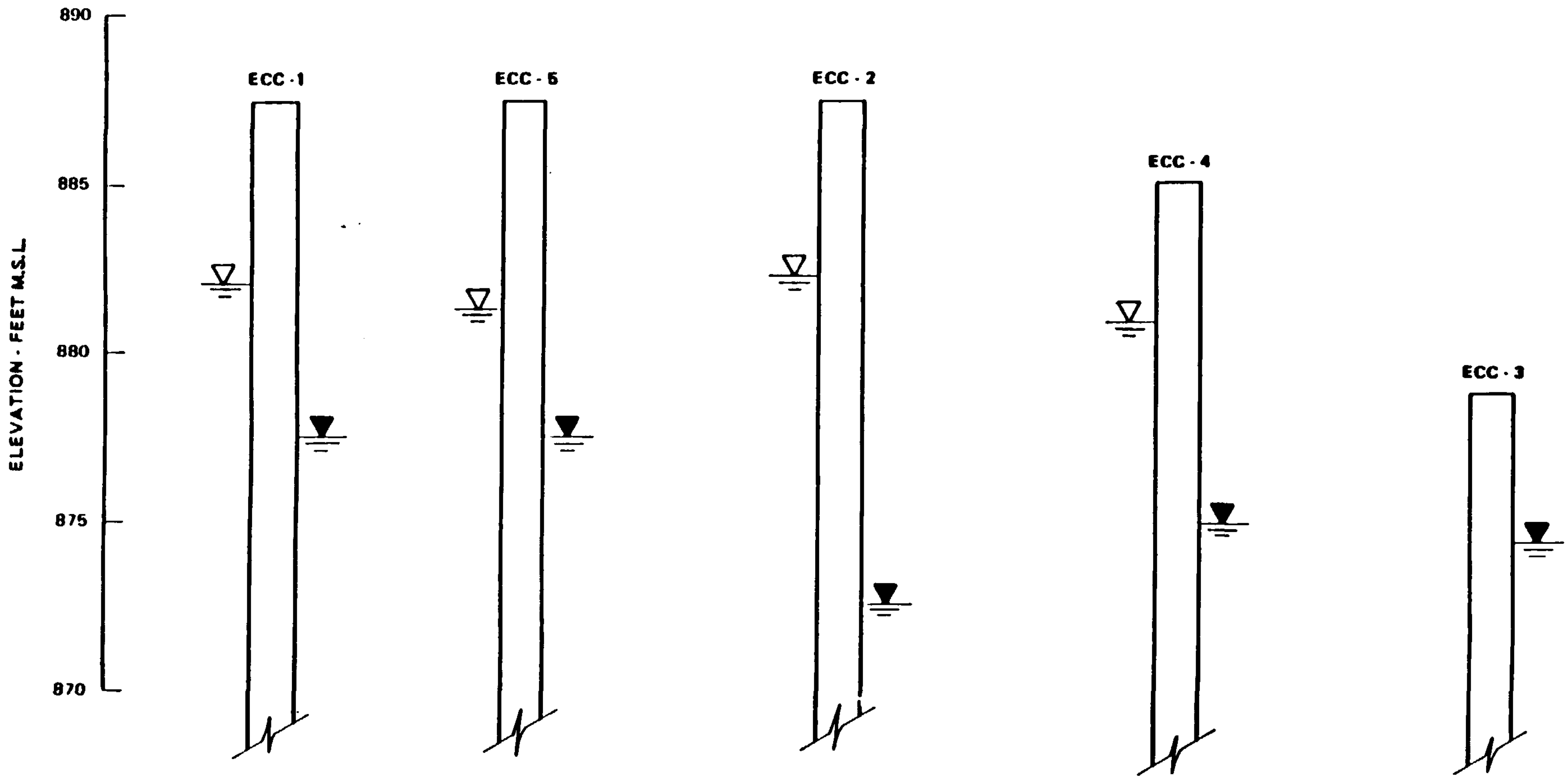
Shallow Saturated Zone. The approximate depth to the saturated zone was identified while drilling with hollow-stem augers and continuous split-spoon sampling. Depths to the saturated zone ranged from 6 feet at ECC-3 to approximately 10 feet at ECC-1, 4 and 5, and to 15 feet at ECC-2. The saturated zone occurred in fine-grained soils, usually clayey silts or silty clays at ECC-1, 2, 4, 5, 6 and 7. At ECC-3, it occurred in a fine sand, relatively free of silt.

The majority of shallow wells are completed in the sand and gravel zone below the uppermost hydrologic unit. Therefore, water levels in these wells may not represent the depth to the saturated zone. In addition, the approximate depth to the saturated zone was identified during drilling of these test borings. The difference in elevation is shown in Figure 4-15. Monitoring wells 3A and 11A are completed in the uppermost hydrogeologic unit and the water level data collected from these wells represents the water table.

The hydraulic conductivity of the shallow saturated zone was estimated from grain size analysis to be $1x10^{-5}$ cm/sec. Slug tests performed on wells installed in this zone at the adjacent NSL site resulted in hydraulic conductivity of $4.9x10^{-4}$ cm/sec.

Shallow Sand and Gravel Aquifer. An areally extensive sand and gravel zone was identified between approximately the 20- and 30-foot depth at ECC-1, 2, 4, 5, 6, 8, 9, and 10. The potentiometric surface of this zone is at a higher elevation than the water table at these boring locations. This zone appears to be a glacial outwash sand and gravel zone, overlain by a silty clay till which, in places, may act as an aquitard. The upper till unit appears to be 10 to 15 feet thick throughout the northern half of the ECC site. At ECC-3, the shallow sand and gravel aquifer was overlain by 5 feet of till. The potentiometric surface of the sand and gravel zone at this well was not found to be appreciably different during drilling of the test boring. The shallow sand and gravel zone at ECC-4 occurs at a higher elevation than at ECC-1, 2, and 5, and the zone consists of a finer, silty sand at ECC-4 than at the other boring locations. The shallow sand and gravel zone identified at the ECC-6, ECC-8, and ECC-9 locations has very similar characteristics to the 20- to 30-foot depth at ECC-1, 2, and 5. At ECC-7, the zone is similar to ECC-4, with large amounts of silt and interbedded clay lenses.

The cooling water pond appears to be excavated below the top of the shallow sand and gravel aquifer as shown in Figure 4-16. Groundwater inflows to the cooling pond were reported to be about 2,500 gallons/hr during the dewatering operation performed by the surface cleanup contractor. This



LEGEND

WATER ELEVATION IN SAND AND GRAVEL AQUIFER AT THE COMPLETION OF WELL

WATER TABLE ELEVATION NOTED WHILE DRILLING

NOTE: Shallow sand and gravel aquifer was not encounteded at ECC - 3

VERTICAL SCALE 1" = 5'

HORIZONTAL - NOT TO SCALE

FIGURE 4-15
HEAD DIFFERENCE BETWEEN THE SHALLOW SATURATED ZONE AND THE SAND AND GRAVEL AQUIFER
ECC RI

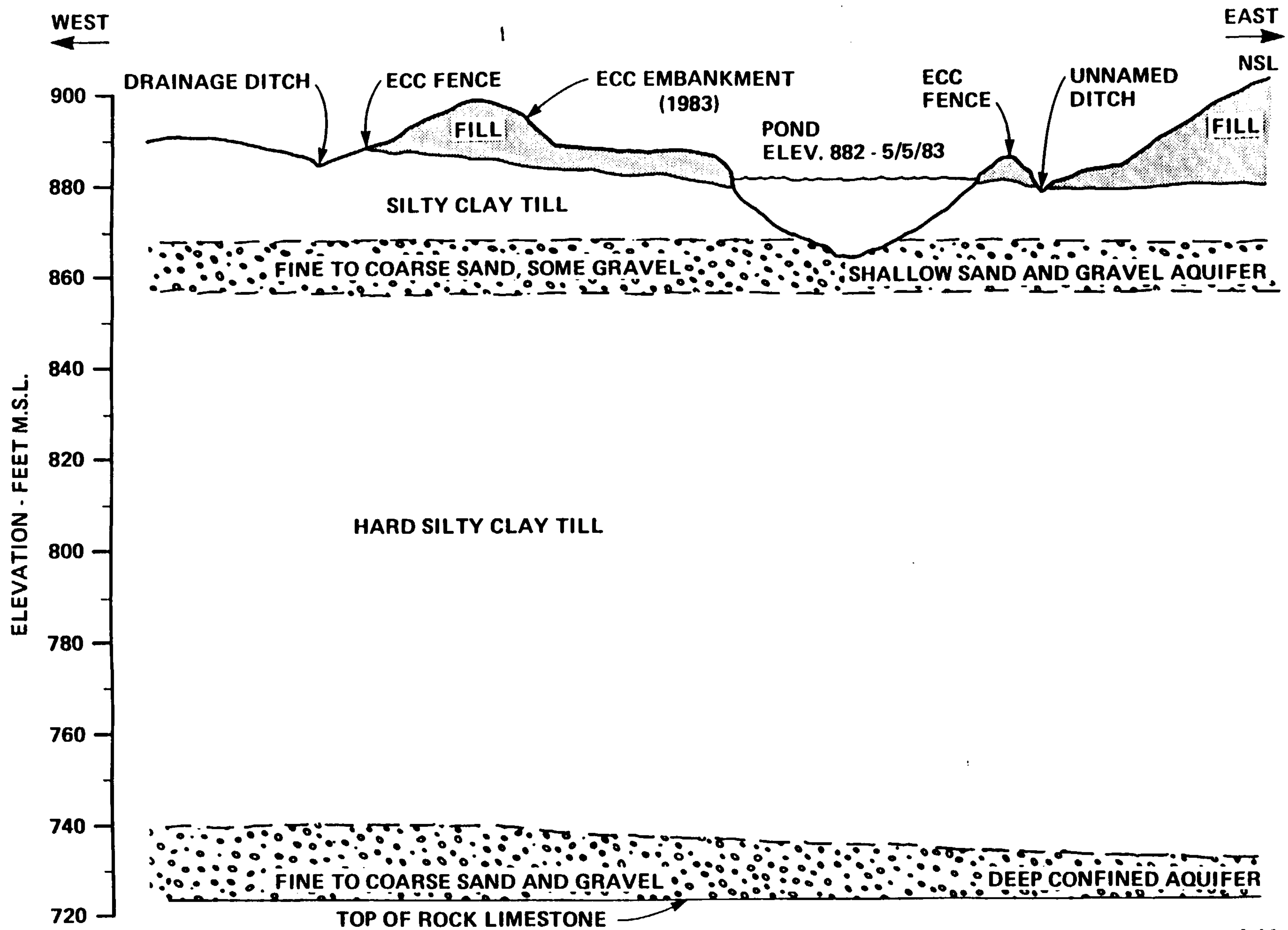


FIGURE 4-16
CONCEPTUAL
HYDROGEOLOGIC
CROSS - SECTION
ECC RI

high influx indicates that pond was excavated into the top of the shallow sand and gravel aquifer.

The hydraulic conductivity of the shallow sand and gravel zone as estimated from grain size analysis ranges from $1x10^{-2}$ to $1x10^{-3}$ cm/sec. Slug tests performed on wells installed as part of the NSL RI in the sand and gravel zone resulted in an hydraulic conductivity of $1.9x10^{-3}$ cm/sec.

Deep Confined Aquifer. A deep confined zone was found in outwash sands and gravels near the top of rock in all four deep borings (see Figure 4-9). The potentiometric surface of this zone is above ground surface throughout the site. This aquifer is confined by an extensive sequence of overlying till, which consists of very stiff to hard clayey silts and silty clays with very low permeabilities (based upon Atterberg limits and visual classification). The natural moisture contents and Atterberg limits indicate that this till is highly overconsolidated.

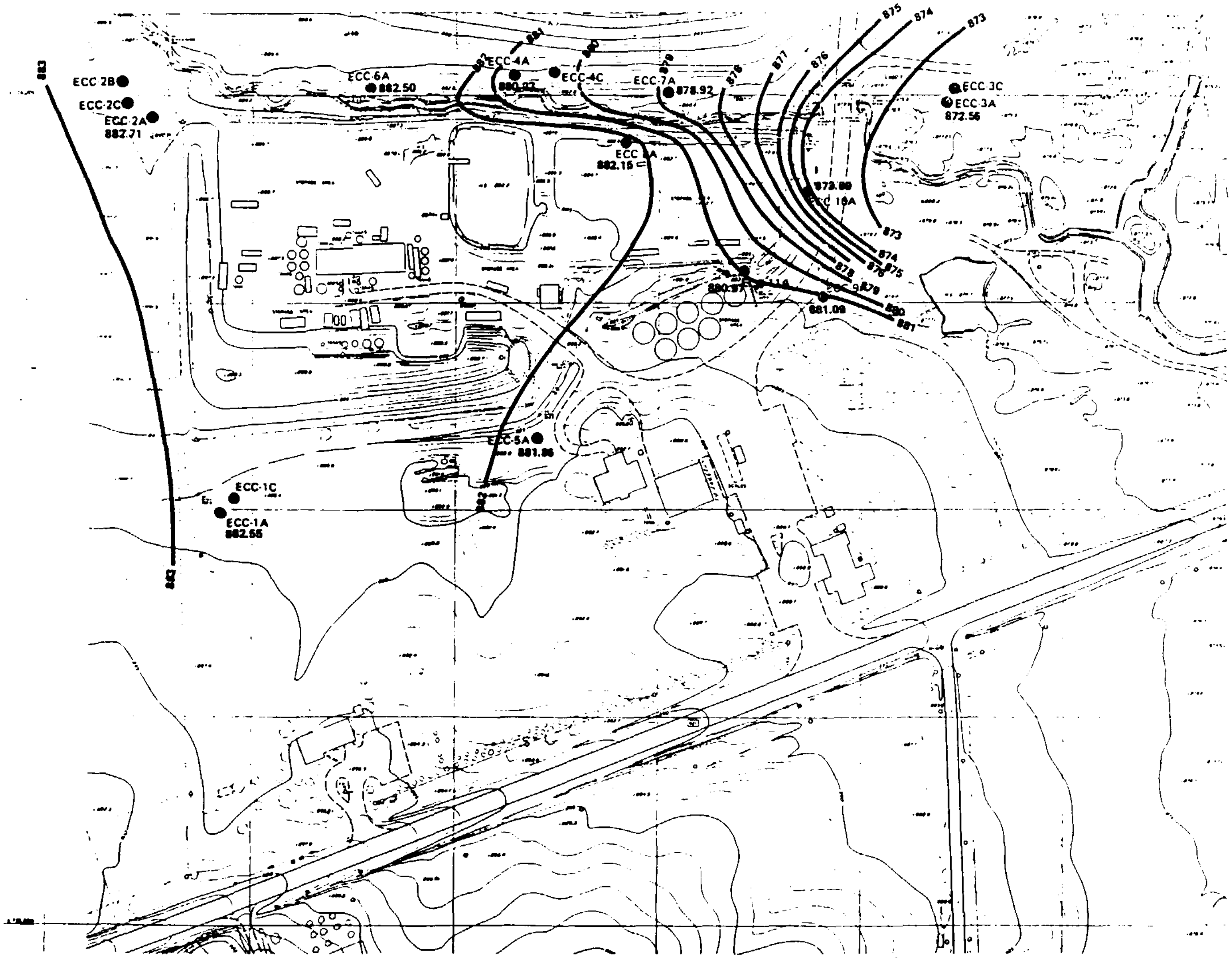
Other Hydrogeologic Units. Several discontinuous sandy zones occur in the till and are water-bearing zones. Monitoring well ECC-2B is completed in such a zone, approximately 100 feet below ground surface. The water level in ECC-2B is very close to the water level in the deep well, ECC-2C. This zone is about 10 feet thick; however, other zones encountered were usually less than 5 feet thick and generally contained considerable amounts of silt and clay.

Groundwater Flow System

Interpretation of the shallow groundwater flow system at the site is difficult because of the heterogeneity of the geologic materials and because of the man-induced changes to the local hydrologic system.

Although the geologic materials of the upper two hydrogeologic units are dissimilar, they appear to be hydraulically connected at some locations around the site. A simplified interpretation of the shallow groundwater flow system is shown in Figure 4-17. Table 4-10 presents groundwater elevations for ECC wells. Groundwater below the site generally appears to travel south and discharge into Finley Creek or the unnamed ditch near its confluence with Finley Creek. Along the eastern edge of the southern half of the site groundwater appears to flow in an eastern direction and discharge into the unnamed ditch.

It is important to note that although data are scant, it appears that upward gradients in the shallow groundwater flow system occur beneath much of the site. In fact, the upper two hydrogeologic units may possibly act as separate aquifers in places. That is, the sand and gravel zone may



LEGEND

● REMEDIAL INVESTIGATION MONITORING WELL
ECC 7A

—882— CONTOURS FOR DECEMBER 1984 DATA

NOTE Map represents topography and onsite features prior to surface cleanup

All well locations are approximate

N

0 100 200
50 150
SCALE IN FEET

FIGURE 4-17
GROUNDWATER CONTOUR MAP
DECEMBER 1984
ECC RI

Table 4-10 (Page 1 of 2)
GROUNDWATER LEVELS IN RI MONITORING WELLS
ECC SITE

Well No.	Ground Surface Elevation Ft. - MSL	Bottom of Well Screen Elevation Ft. - MSL	Top Casing Elevation Ft. - MSL	Feet from Ground Surface[a]	Elevation Ft. - MSL	Date Recorded
ECC-1A	887.13	858.63	890.13	-5.46	881.67	6/29/83
				-5.67	881.46	7/19/83
				-6.24	880.89	9/1/83
				-5.45	881.68	11/29/83
				-4.58	882.55	12/12/84
ECC-1C	886.76	726.16	889.46	+5.06	891.82	6/29/83
				+4.70	891.46	7/18/83
				+3.99	890.75	11/29/83
				+2.50	889.26	12/13/84
ECC-2A	887.21	859.71	890.21	-5.15	882.06	6/29/83
				-5.43	881.78	7/19/83
				-6.15	881.06	9/1/83
				-5.31	881.90	11/29/83
				-4.50	882.71	12/12/84
ECC-2B	886.65	784.45	889.65	+5.19	891.84	6/29/83
				+4.34	890.99	7/20/83
				+3.78	890.43	11/29/83
				+2.10	888.75	12/13/84
ECC-2C	886.80	727.30	889.70	+5.09	891.89	6/29/83
				+4.78	891.58	7/18/83
				+3.78	890.67	11/29/83
				+2.29	889.09	12/13/84
ECC-3A	876.47	861.47	878.87	-4.31	872.16	6/29/83
				-5.13	871.34	7/19/83
				-4.90	871.57	9/1/83
				-5.26	871.21	11/29/83
				-3.91	872.56	12/12/84
ECC-3C	877.19	729.89	879.59	+12.52	889.71	6/29/83
				+12.24	889.43	7/20/83
				+13.30	890.49	11/30/83
ECC-4A	884.34	870.34	887.24	-4.11	880.23	6/29/83
				-4.38	879.96	7/19/83
				-4.66	879.68	9/1/83
				-3.51	880.83	12/12/84

Table 4-10 (Page 2 of 2)

Well No.	Ground Surface Elevation Ft. - MSL	Bottom of Well Screen Elevation Ft. - MSL	Top Casing Elevation Ft. - MSL	Feet from Ground Surface[a]	Elevation Ft. - MSL	Date Recorded
ECC-4C	884.54	725.54	887.24	+7.71	892.25	6/29/83
				+6.93	891.47	7/18/83
				+6.10	890.64	11/30/83
				+4.65	889.19	12/13/84
ECC-5A	887.25	863.55	889.85	-6.10	881.15	6/29/83
				-6.49	880.76	7/19/83
				-6.92	880.33	9/1/83
				-6.19	881.06	11/30/83
				-5.39	881.86	12/12/84
ECC-6A	885.50	862.50	887.62	-4.45	881.05	9/2/83
				-3.59	881.91	11/30/83
				-3.12	882.50	12/12/84
ECC-7A	881.53	859.53	883.93	-8.50[b]	873.03[b]	9/1/83
				-2.43	879.10	11/30/83
				-2.61	878.92	12/12/84
ECC-8A	885.42	860.42	886.22	-3.27	882.15	12/12/84
ECC-9A	881.01	856.01	883.11	+0.08	881.09	12/12/84
ECC-10A	879.60	859.60	882.30	-5.71	873.89	12/12/84
ECC-11A	884.40	870.40	886.90	-3.43	880.97	12/12/84

[a] Positive sign indicates water level above ground surface; negative sign indicates water level below ground surface.
[b] Noted while drilling with hollow stem augers.

GLT360/50-2

be semiconfined in places due to lithologic variations in the upper saturated zone. Hydraulic gradients in the shallow flow system vary between approximately 0.01 ft/ft and 0.06 ft/ft. The actual gradients directly beneath the site are uncertain.

Water level data in the deep, confined aquifer indicate that flow is generally north to south. The maximum observed gradient in the deep confined aquifer was found to be 0.005 between wells ECC-3C and ECC-4C. Vertical gradients are upward since the potentiometric surface of the zone is above ground surface.

Groundwater Contamination

Monitoring Well Results. The 15 monitoring wells at ECC were sampled in three phases during the RI. Samples were analyzed at the CLP for inorganics, volatiles, acids, base/neutrals, pesticides and PCB's.

Inorganic results from all three phases of sampling are presented in Table 4-11 for the shallow monitoring wells and in Table 4-12 for the deep and intermediate wells. Two wells monitor the shallow saturated zone, well 3A and 11A. Background water quality is represented by wells 1A and 2A in shallow sand and gravel aquifer upgradient of the site. Inorganic analysis was not performed on well 11A samples due to very slow well recharge.

Inorganic constituents in well 3A found exceeding water quality standards or criteria and exceeding background levels in 1A and 2A are barium, iron, and nickel. Barium is only slightly above the primary drinking water standard of 1,000 ug/l. Iron is substantially above background though it is an aesthetic (taste) concern only. Nickel exceeded the EPA water quality criteria in well 3A although the background level in 2A also exceeded the criteria.

Inorganic constituents in the shallow confined aquifer found exceeding water quality standards or criteria and exceeding the background levels in wells 1A and 2A are:

- Aluminum in wells 5A and 7A
- Chromium in well 7A
- Iron in well 5A and 7A
- Lead in well 7A
- Nickel in 7A

The aluminum levels in 5A (1,720 ug/l) and 7A (61,500 ug/l) exceed the EPA drinking water criteria of 73 ug/l. The background levels in 1A also exceed the criteria though not by the same extent. Barium is higher than background in well 7A, though it does not exceed the primary drinking water

TABLE 4-11
GROUNDWATER INORGANIC RESULTS (ug/L)
SHALLOW MONITORING WELLS
ECC Site RI Report

		Sample Location:	1A-001	1A-01	1A-02	1A-001	2A-001	2A-01	2A-001	3A-001	3A-002	3A-01	3A-001
		Date Sampled:	07-19-83	11-29-83	11-29-83	12-13-84	07-19-83	11-29-83	12-13-84	07-19-83	07-19-83	11-29-83	12-13-84
		ITR Number:	MS0283	MS0927	MS0928	ME4629	MS0284	MS0930	ME4628	MS0285	MS0288	MS0933	ME4625
COMPOUND	DETECTABLE LIMITS	QUALITY CRITERIA c											
ALUMINUM	200	—			406	304			[65]	830	320		[128]
ANTIMONY	20	146 d											
ARSENIC	10	50 j											15
BARIUM	100	1000 j	306	366	357	328	330	260	287	570	560	1070	860
BERYLLIUM	5	0.0039 g											
CADMIUM	1	10 j											
CALCIUM	—	—	N/A	N/A	N/A	95770 E	N/A	N/A	98200 E	N/A	N/A	N/A	70240 E
CHROMIUM	10	50 j				11			11	13			15
COBALT	50	—											
COPPER	50	1000 e											[16]
IRON	50	300 e	1390	3070	3300	1454	2740	3360	2931	8300	6330	10400	297
LEAD	5	50 j				6.7							
CYANIDE	10	200 d											
MAGNESIUM	—	—	N/A	N/A	N/A	34660 E	N/A	N/A	32070 E	N/A	N/A	N/A	131000 E
MANGANESE	10	50 e	110	103	95	66	56	49	49	260	230	97	70
MERCURY	0.2	0.014 d	0.4 b				0.3 b	0.4		0.3 b			
NICKEL	40	13.4 d							65	42	77	80	84
POTASSIUM	—	—											105940
SELENIUM	2	10 j								3	4		
SILVER	10	50 j		25	14								
SODIUM	—	—	N/A	N/A	N/A	10060	N/A	N/A	15490	N/A	N/A	N/A	380700
THALLIUM	10	18 d											
TIN	20	—											
VANADIUM	200	—											
ZINC	10	5000 e		45	14	69		11	260			19	250

FOOTNOTES:

a- QA data indicate the presence of these metal contaminants in the laboratory method blank
b- This metal was also detected in the analysis of the field blank.
c- U.S.EPA Drinking Water Quality Criteria or National Drinking Water Standards.
d- Water Quality Criteria for Human Health - Tocicity Protection (adjusted for consumption of water only.)
e- Secondary drinking water standard.
g- Water Quality Criteria for Human Health - U.S.EPA assigned carcinogen risk level of 10 -6 (adjusted for consumption of water only). One additional case of cancer in a population of 1,000,000
h- No adverse effect level calculated by NAS/NRC.
j- Primary drinking water standard.
E- Value is estimated or not reported due to the presence of interference.
R- Spike sample recovery is not within control limits.
[]- Positive values less than the contract required detection limit.
N/A- Not analyzed for.
— Criteria has not been established for this compound.

TABLE 4-11
GROUNDWATER INORGANIC RESULTS (ug/L)
SHALLOW MONITORING WELLS
ECC Site RI Report

COMPOUND	DETECTABLE LIMITS	QUALITY CRITERIA c	5A-001 07-19-83 MS0286	5A-01 11-30-83 MS0936	5A-001 12-12-84 ME4622	5A-002 12-12-84 ME4630	6A-01 11-30-83 MS0937	6A-001 12-13-84 ME4627	7A-01 11-30-83 MS0938	7A-02 11-30-83 MS0939	7A-001 12-13-84 ME4626	8A-001 12-13-84 ME4631	10A-001 12-12-84 ME4624	BLANK 07-19-83 MS0276	BLANK 11-30-83 MS0940	BLANK 12-13-84 ME4632
ALUMINUM	200	—	1720	361		[140]		[66]	61500	663	[77]	[144]	[72]			[57]
ANTIMONY	20	146 d	4													
ARSENIC	10	50 j														
BARIUM	100	1000 j	390	392	413	438	508	612	875	397	331	353	298			
BERYLLIUM	5	0.0039 g														
CADMIUM	1	10 j														
CALCIUM	—	—	N/A	N/A	94890	99410 E	N/A	161100 E	N/A	N/A	73550 E	98580 E	77000 E	N/A	N/A	[900] E
CHROMIUM	10	50 j	11		13	12			144							
COBALT	50	—							80							
COPPER	50	1000 e							106							
IRON	50	300 e	7410	3280	202	356	5470	1194	105000	1030	[73]	2545	[51]		210	[98]
LEAD	5	50 j							102		6.5					
CYANIDE	10	200 d														
MAGNESIUM	—	—	N/A	N/A	33140 E	34160 E	N/A	69730 E	N/A	N/A	29780 E	38890 E	31440 E	N/A	N/A	[334] E
MANGANESE	10	50 e	161	52	73	50	231	94	1930	113	57	24	40			
MERCURY	0.2	0.014 d							0.2					11.2 a	0.8	
NICKEL	40	13.4 d			[32]			46	176							[34]
POTASSIUM	—	—						[2129]			[2625]	[1195]	[4765]			
SELENIUM	2	10 j														
SILVER	10	50 j													20	
SODIUM	—	—	N/A	N/A	10980	11210	N/A	118000	N/A	N/A	22300	15130	25520	N/A	N/A	1424
THALLIUM	10	18 d	0.4											0.4		
TIN	20	—														
VANADIUM	200	—														
ZINC	10	5000 e		36	155	158	35	42	276	31	37	69			49	31

FOOTNOTES:

a- QA data indicate the presence of these metal contaminants in the laboratory method blank
b- This metal was also detected in the analysis of the field blank.
c- U.S.EPA Drinking Water Quality Criteria or National Drinking Water Standards.
d- Water Quality Criteria for Human Health - Tocicity Protection (adjusted for consumption of water only.)
e- Secondary drinking water standard.
g- Water Quality Criteria for Human Health - U.S.EPA assigned carcinogen risk level of 10 -6 (adjusted for consumption of water only). One additional case of cancer in a population of 1,000,000
h- No adverse effect level calculated by NAS/NRC.
j- Primary drinking water standard.
E- Value is estimated or not reported due to the presence of interference.
R- Spike sample recovery is not within control limits.
[]- Positive values less than the contract required detection limit.
N/A- Not analyzed for.
— Criteria has not been established for this compound.

TABLE 4-12
GROUNDWATER INORGANIC RESULTS (ug/L)
DEEP & INTERMEDIATE MONITORING WELLS
ECC Site RI Report

				DEEP WELLS									INTERMEDIATE WELLS	
			Sample Location:	1C-001	1C-01	2C-001	2C-01	3C-001	3C-01	4C-001	4C-002	4C-01	2B-001	2B-01
			Date Sampled:	07-18-83	11-29-83	07-18-83	11-29-83	07-18-83	11-30-84	07-18-83	07-18-83	11-30-83	07-19-83	11-29-83
			ITR Number:	MS0270	MS0929	MS0272	MS0932	MS0273	MS0934	MS0274	MS0275	MS0935	MS0271	MS0931
COMPOUND		DETECTABLE LIMITS	QUALITY CRITERIA c											
ALUMINUM		200	—											
ANTIMONY		20	146 d											
ARSENIC		10	50 j											
BARIUM		100	1000 j	660	657	380	470	210	264	510	510	563	150	188
BERYLLIUM		5	0.0039 g											
CADMIUM		1	10 j											
CALCIUM	N/A	—	—											
CHROMIUM		10	50 j											
COBALT		50	—											
COPPER		50	1000 e											
IRON		50	300 e	600	736	670	875	1020	1720	850	970	1000	920	1140
LEAD		5	50 j											
CYANIDE		10	200 d											
MAGNESIUM	N/A	—	—											
MANGANESE		10	50 e	22	28	17	23	51	39		22	23	54	54
MERCURY		0.2	0.014 d				0.4						0.3 b	
NICKEL		40	13.4 d							42	52			
POTASSIUM		—	—											
SELENIUM		2	10 j											
SILVER		10	50 j				33		25			19		27
SODIUM	N/A	—	—											
THALLIUM		10	18 d											
TIN		20	—											
VANADIUM		200	—											
ZINC		10	5000 e		19		26					74		

FOOTNOTES:

a- QA data indicate the presence of these metal contaminants in the laboratory method blank
b- This metal was also detected in the analysis of the field blank.
c- U.S.EPA Drinking Water Quality Criteria or National Drinking Water Standards.
d- Water Quality Criteria for Human Health - Tocicity Protection (adjusted for consumption of water only.)
e- Secondary drinking water standard.
g- Water Quality Criteria for Human Health - U.S.EPA assigned carcinogen risk level of 10 -6 (adjusted for consumption of water only). One additional case of cancer in a population of 1,000,000.
h- No adverse effect level calculated by NAS/NRC.
j- Primary drinking water standard.
E- Value is estimated or not reported due to the presence of interference.
R- Spike sample recovery is not within control limits.
[]- Positive values less than the contract required detection limit.
N/A- Not analyzed for.
— Criteria has not been established for this compound.

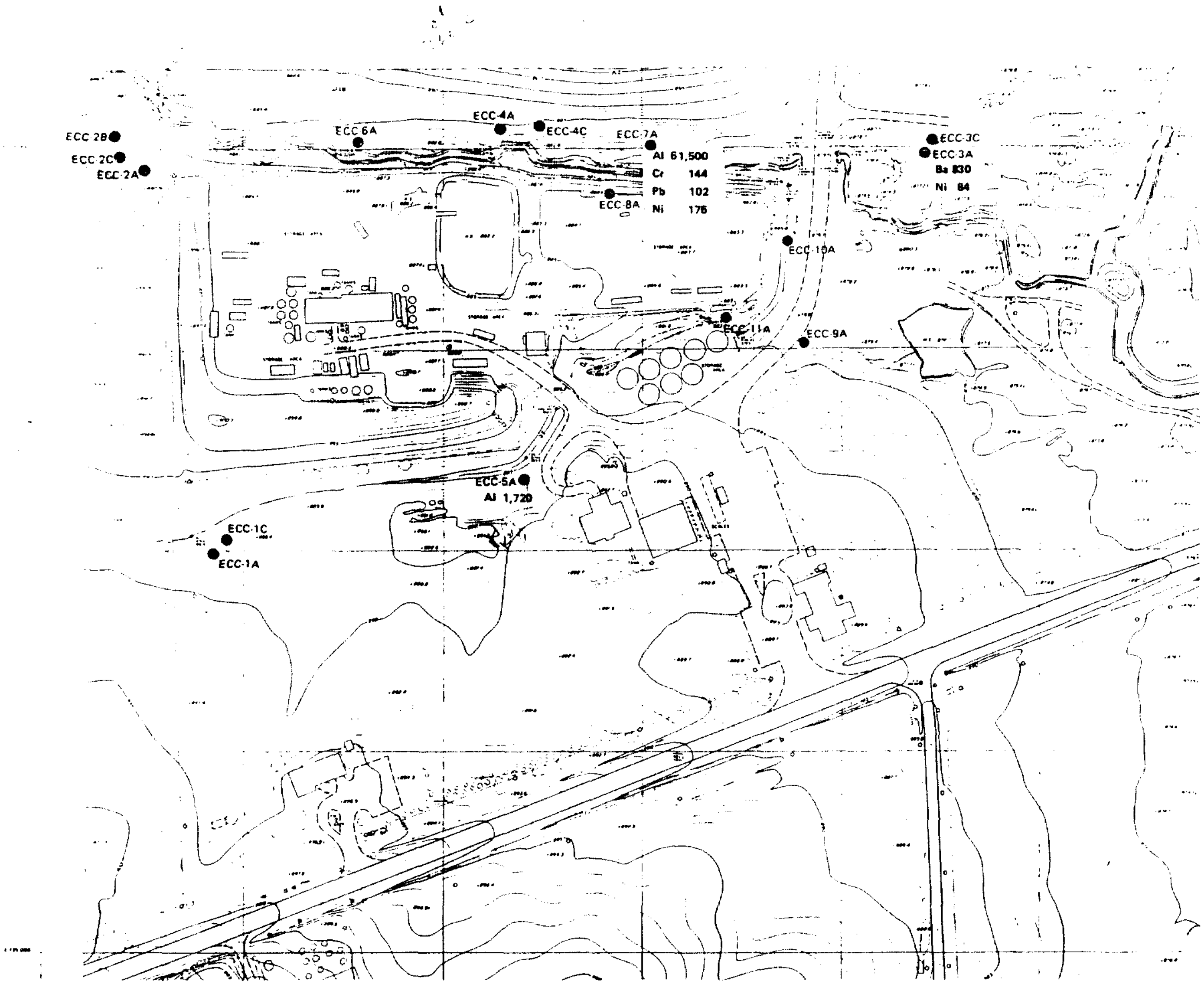
standard of 1,000 ug/l there. Chromium exceeds the primary drinking water standard of 50 ug/l in well 7A, where, it is 144 ug/l. The secondary water quality standard for iron was exceeded in all shallow wells, including background. In wells 5A and 7A levels were substantially higher than background. These levels are not a health threat. Lead was twice the primary drinking water criteria in well 7A where it was 102 ug/l. Nickel exceeded the EPA water quality criteria in well 7A as well as the background well 2A. Only in well 7A was it substantially higher than the background level. In summary, shallow wells 5A and 7A appear to have inorganic constituents in levels exceeding background that also exceed water quality criteria or standards. Figure 4-18 presents the distribution of inorganic constituents exceeding background levels and water quality criteria or primary drinking water standards.

In the deep confined aquifer inorganic constituents did not exceed background levels. Two inorganics, manganese and nickel, however, do exceed criteria or standards.

Organic results for the shallow monitoring wells are presented in Table 4-13 and for the deep and intermediate wells in Table 4-14. As discussed previously, wells 1A and 2A are representative of background water quality.

Several organics found in these wells and other shallow as well as deep wells are due to sampling bottle and/or laboratory contamination. Methylene chloride was found in nearly all samples and field blanks. It is used in preparatory cleaning of the VOA vials used for the samples. Acetone also was found in numerous samples as well as field blanks. Reagent grade acetone was used for equipment decontamination. Tetrachloroethene and trichloroethene were detected in wells 1A, 2A, and 5A at levels less than 9 ug/l quantification limit during the November 29-30, 1983 sampling. These levels are not considered to be representative of the groundwater since they were not detected in sampling phases before and after the other sampling events. Also wells 1A and 2A are upgradient of the site and would not be expected to show contamination.

Wells 3A and 11A monitoring the shallow saturated zone were found to be contaminated. Well 11A had high levels of trans-1,2-dichloroethene (4,000 ug/l) and trichloroethene (28,000 ug/l). Well 3A is contaminated with 13 VOC's. Compounds substantially above water quality criteria are benzene (<9 ug/l) 1,1-dichloroethane (96 ug/l), chloroform (<9 ug/l), 1,1-dichloroethene (10 ug/l), trans-1,3-dichloropropene (77.5 ug/l), trichloroethene (9 ug/l), and vinyl chloride (85.8 ug/l). Well 3A also contained five base/neutral compounds, one of which, pyrene, was quantifiable. Pyrene



LEGEND

● REMEDIAL INVESTIGATION MONITORING WELL
ECC-7A

NOTE: All well locations are approximate.

N

0 100 200
50 150
SCALE IN FEET

FIGURE 4-18
GROUNDWATER INORGANIC CONSTITUENTS EXCEEDING BACKGROUND LEVELS AND WATER QUALITY CRITERIA OR PRIMARY DRINKING WATER STANDARDS (ug/l)
ECC RI

TABLE 4-13
GROUNDWATER ORGANIC RESULTS (ug/L)
SHALLOW MONITORING WELLS
ECC Site RI Report

Sample Location:		Date Sampled: / ITR Number:		1A-001	1A-01	1A-02	1A-001	2A-001	2A-01	2A-001	3A-001	3A-002	3A-01	3A-001	5A-001	5A-01
				07-19-83	11-29-83	11-29-83	12-13-84	07-19-83	11-29-83	12-13-84	07-19-83	07-18-83	11-29-83	12-13-84	07-19-83	11-30-83
				S2383	S2803	S2801	E7493	S2384	S2804	E7492	S2385	S2388	S2807	E7489	S2386	S2810
VOLITILE COMPOUNDS		DETECTABLE LIMITS	QUALITY CRITERIA c													
BENZENE		5	0.67 g										9 K	4 J		
1, 1, 1-TRICHLOROETHANE		5	1900 d								5 K					
1, 1-DICHLOROETHANE		5	0.94 g								96	86	51.2			
CHLOROETHANE		10	—								120	116	40.7	100		
CHLOROFORM		5	0.19 g										9 K			
1, 1-DICHLOROETHENE			0.033 g											10		
TRANS-1, 2-DICHLOROETHENE		5	—								19	16	9 K			
TRANS-1, 3-DICHLOROPROPENE			87 d										77.5			
ETHYLBENZENE			2400 d										9 K	3 J		
METHYLENE CHLORIDE		5	0.19 g		9 KB	9 KB	22		11 B	3 J	8 B	8 K	18 B	7		9 KB
TRICHLOROFLUOROMETHANE		5	0.19 g													
TETRACHLOROETHENE		5	0.8 g		9 K	9 K			9 K							9 K
TOLUENE		5	15000 d										9 K			
TRICHLOROETHENE			2.8 g		9 K	9 K			9 K		9	7	9 K			9 K
VINYL CHLORIDE		5	2.0 g								7	6	85.8			
ACETONE	i		—		9649 B	9897 B		640	3016 B		1400	1400	15030 B		490	54.5 B
2-BUTANONE		5	—		9 K											
STYRENE	i	5	900 h													
TOTAL XYLENES			1400 m					9					12			
TOTAL VOC's	j			0	27	18	0	9	18	0	256	231	320	117	0	18
BASE/NEUTRAL COMPOUNDS																
FLUORANTHENE		20	188 d								20 K	20 K				
ISOPHORONE		20	5500 d								20 K	20 K				
N-NITROSODIPROPLYAMINE			—													
BIS(2-ETHYLHEXYL)PHTHALATE		20	21000 d			23 K										
DIETHYL PHTHALATE		20	440000 d								20 K	20 K				
CHRYSENE		20	0.0031 g								20 K	20 K				
PYRENE		20	0.0031 g								30	30				
TOTAL BASE/NEUTRAL COMPOUNDS				0	0	23	0	0	0	0	110	110	0	0	0	0
TENTATIVELY IDENTIFIED COMPOUNDS	A															
1,1-OXYBISETHANE												13				
2-METHYL-2-BUTANOL								4.2				4.2			5.8	
TETRAHYDROFURAN																
TRIPHENYLESTER PHOSPHORIC ACID															6.0	

FOOTNOTES:

A. Tentatively identified compound concentrations are estimated. A 1:1 response is assumed.
B. Analyte has been found in the laboratory or field blank as well as the sample. Indicates probable contamination.
C. Applies to pesticide parameters where the identicication has been confirmed by GC/MS.
J. Indicates an estimated value. When mass spectral data indicates the presence of a compound that meets the identification criteria and the result is less than the specified detection limit but greater than zero.
K. Actual value, within the limitations of the method is less than the value given
N/A- Not analyzed for.
c- U.S.EPA Drinking Water Quality Criteria or National Drinking Water Standards.
d- Water Quality Criteria for Human Health - Toxicity Protection (adjusted for consumption of water only).
e- Secondary Drinking Water Standard.
g- Water Quality Criteria for Human Health - U.S.EPA assigned carcinogen risk level of 10 -6 (adjusted for cosumption of water only). One additional case of cancer in a population of 1,000,000.
h- No adverse effect level calculated by NAS/NRC.
i- Nonpriority hazardous substance.
j- Total VOC's do not include the likely bottle and sampling contaminants methylene chloride and acetone, or other probable contaminants with footnote B.
m- U.S.EPA 10-day health advisory level.

NOTE: SAMPLES ANALYZED FOR ROUTINE ORGANIC PACKAGE BUT ONLY DETECTED COMPOUNDS ARE LISTED

TABLE 4-13
GROUNDWATER ORGANIC RESULTS (ug/L)
SHALLOW MONITORING WELLS
ECC Site RI Report

Sample Location: / Date Sampled: / ITR Number:			5A-001 12-12-84 E7486	5A-002 12-12-84 E7494	6A-01 11-30-83 S2811	6A-001 12-13-84 E7491	7A-01 11-30-83 S2812	7A-02 11-30-83 S2813	7A-001 12-13-84 E7490	8A-001 12-13-84 E7495	9A-001 12-13-84 E7487	10A-001 12-12-84 E7488	11A-001 12-13-84 E7485	BLANK-001 07-19-83 S2376	BLANK 11-30-83 S2814.	BLANK 12-13-84 E7496
VOLITILE COMPOUNDS	DETECTABLE LIMITS	QUALITY CRITERIA c														
BENZENE	5	0.67 g							4 J							
1, 1, 1-TRICHLOROETHANE	5	1900 d								7						
1, 1-DICHLOROETHANE	5	0.94 g														
CHLOROETHANE	10	—							90			29				
CHLOROFORM	5	0.19 g				3 JB										6
1, 1-DICHLOROETHENE		0.033 g							9	6		8				
TRANS-1, 2-DICHLOROETHENE	5	—								13		3 J	4000			
TRANS-1, 3-DICHLOROPROPENE		87 d														
ETHYLBENZENE		2400 d							4 J							
METHYLENE CHLORIDE	5	0.19 g	3 J	4 J	19.5 B		16.5 B	9 KB	3 J	64	2 J	4 J		34	9 B	
TRICHLOROFLUOROMETHANE	5	0.19 g													11.6	
TETRACHLOROETHENE	5	0.8 g						9 K								
TOLUENE	5	15000 d													9 K	
TRICHLOROETHENE		2.8 g								21	3 J		20000			
VINYL CHLORIDE	5	2.0 g														
ACETONE i		—			4284 B	24 B	23.9 B	38.3 B		52 B	41 B	53 B			9 KB	100
2-BUTANONE	5	—										26 B				10
STYRENE i	5	900 h														
TOTAL XYLENES		1400 m					9 K									
TOTAL VOC's j			0	0	0	0	9	9	107	47	3	40	32000	0	21	16
BASE/NEUTRAL COMPOUNDS																
FLUORANTHENE	20	188 d														
ISOPHORONE	20	5500 d														
N-NITROSODIPROPLYAMINE		—														
BIS(2-ETHYLHEXYL)PHTHALATE	20	21000 d														99
DIETHYL PHTHALATE	20	440000 d														
CHRYSENE	20	0.0031 g														
PYRENE	20	0.0031 g														
TOTAL BASE/NEUTRAL COMPOUNDS			0	0	0	0	0	0	0	0	0	0	0	0	0	99
TENTATIVELY IDENTIFIED COMPOUNDS A																
1,1-OXYBISETHANE																
2-METHYL-2-BUTANOL																
TETRAHYDROFURAN														3.8		
TRIPHENYLESTER PHOSPHORIC ACID																

FOOTNOTES:

A. Tentatively identified compound concentrations are estimated. A 1:1 response is assumed.
B. Analyte has been found in the laboratory or field blank as well as the sample. Indicates probable contamination.
C. Applies to pesticide parameters where the identicication has been confirmed by GC/MS.
J. Indicates an estimated value. When mass spectral data indicates the presence of a compound that meets the identification criteria and the result is less than the specified detection limit but greater than zero.
K. Actual value, within the limitations of the method is less than the value given
N/A- Not analyzed for.
c- U.S.EPA Drinking Water Quality Criteria or National Drinking Water Standards.
d- Water Quality Criteria for Human Health - Toxicity Protection (adjusted for consumption of water only).
e- Secondary Drinking Water Standard.
g- Water Quality Criteria for Human Health - U.S.EPA assigned carcinogen risk level of 10 -6 (adjusted for consumption of water only). One additional case of cancer in a population of 1,000,000.
h- No adverse effect level calculated by NAS/NRC.
i- Nonpriority hazardous substance.
j- Total VOC's do not include the likely bottle and sampling contaminants methylene chloride and acetone, or other probable contaminants with footnote B.
m- U.S.EPA 10-day health advisory level.

NOTE: SAMPLES ANALYZED FOR ROUTINE ORGANIC PACKAGE BUT ONLY DETECTED COMPOUNDS ARE LISTED

TABLE 4-14
GROUNDWATER ORGANIC RESULTS (ug/L)
DEEP & INTERMEDIATE MONITORING WELLS
ECC Site RI Report

			DEEP WELLS									INTERMEDIATE WELLS	
		Sample Location:	1C-001	1C-01	2C-001	2C-01	3C-001	3C-01	4C-001	4C-002	4C-01	2B-001	2B-01
		Date Sampled:	07-18-83	11-29-83	07-18-83	11-29-83	07-18-83	11-30-83	07-18-83	07-18-83	11-30-83	07-19-83	11-25-83
		ITR Number:	S2370	S2802	S2372	S2806	S2373	S2808	S2374	S2375	S2809	S2371	S2805
VOLATILE COMPOUNDS	DETECTABLE LIMITS	QUALITY CRITERIA c											
BENZENE	5	0.67 g											
1, 1, 1-TRICHLOROETHANE	5	1900 d											
1, 1-DICHLOROETHANE	5	0.94 g											
CHLOROETHANE	10	-											
CHLOROFORM	5	0.19 g											
1, 1-DICHLOROETHENE		0.033 g											
TRANS-1, 2-DICHLOROETHENE	5	-											
TRANS-1, 3-DICHLOROPROPENE		87 d											
ETHYLBENZENE		2400 d											
METHYLENE CHLORIDE	5	0.19 g		9 K		9 KB	5 K	12.4 B			9 K		9 K
TRICHLOROFLUOROMETHANE	5	0.19 g											
TETRACHLOROETHENE	5	0.8 g											
TOLUENE	5	15000 d											
TRICHLOROETHENE		2.8 g											
VINYL CHLORIDE	5	2.0 g											
ACETONE i		-		9 KB	100 K	9 KB		550.7 B			9 KB		9 KB
2-BUTANONE	5	-											
STYRENE i	5	900 h			5 K								
TOTAL XYLENES		1400 m				9 K							
TOTAL VOC's j			0	0	5	9	0	0	0	0	0	0	0
BASE/NEUTRAL COMPOUNDS													
FLUORANTHENE	20	188 d											
ISOPHORONE	20	5500 d											
N-NITROSODIPROPLYAMINE													
BIS(2-ETHYLHEXYL)PHTHALATE	20	21000 d											
DIETHYL PHTHALATE	20	440000 d											
CHRYSENE	20	0.0031 g											
PYRENE	20	0.0031 g											
TOTAL BASE/NEUTRAL COMPOUNDS			0	0	0	0	0	0	0	0	0	0	0
TENTATIVELY IDENTIFIED COMPOUNDS A													
1,1-OXYBISETHANE													
2-METHYL-2-BUTANOL													
TETRAHYDROFURAN													
TRIPHENYLESTER PHOSPHORIC ACID													

FOOTNOTES:
A. Tentatively identified compound concentrations are estimated. A 1:1 response is assumed.
B. Analyte has been found in the laboratory or field blank as well as the sample. Indicates probable contamination.
C. Applies to pesticide parameters where the identicication has been confirmed by GC/MS.
J. Indicates an estimated value. When mass spectral data indicates the presence of a compound that meets the identification criteria and the result is less than the specified detection limit but greater than zero.
K. Actual value, within the limitations of the method is less than the value given
N/A- Not analyzed for.
c- U.S.EPA Drinking Water Quality Criteria or National Drinking Water Standards.
d- Water Quality Criteria for Human Health - Toxicity Protection (adjusted for consumption of water only).
e- Secondary Drinking Water Standard.
g- Water Quality Criteria for Human Health - U.S.EPA assigned carcinogen risk level of 10 -6 (adjusted for comsumption of water only). One additional case of cancer in a population of 1,000,000.
h- No adverse effect level calculated by NAS/NRC.
i- Nonpriority hazardous substance.
j- Total VOC's do not include the likely bottle and sampling contaminants methylene chloride and acetone, or other probable contaminants with footnote B.
m- U.S.EPA 10-day health advisory level.

NOTE: SAMPLES ANALYZED FOR ROUTINE ORGANIC PACKAGE BUT ONLY DETECTED COMPOUNDS ARE LISTED

was found at 30 ug/l, substantially higher than the water quality criteria.

Organic groundwater contaminants in the shallow sand and gravel aquifer were found in wells 7A, 8A, 9A, and 10A. The following VOC's were most significant:

- o 1,1-dichloroethane, well 8A
- o Chloroethane, wells 7A and 10A
- o 1,1, dichloroethene, wells 7A, 8A, and 10A
- o Trichloroethene, well 8A

Figure 4-19 presents the distribution of total volatile organics and total base/neutrals.

No organic groundwater contaminants were found in the wells monitoring the deep confined aquifer.

In summary, the greatest organic contamination was found in the shallow saturated zone at well 11A, with lesser amounts at well 3A. The shallow sand and gravel aquifer was found to be contaminated at wells 7A, 8A, and 10A. The deep aquifer was not found to be contaminated.

Residential Well Results. Six residential wells were sampled and analyzed for the full CLP inorganics and organics data packages (Figure 4-20). Inorganic results are presented in Table 4-15. Quality assurance review of laboratory data found reliability of the inorganic analysis to be strongly suspect and not considered useable. As discussed in Chapter 3, however, previous analysis of residential well samples has not found inorganics exceeding water quality standards with the exception of one sample at the Jennings well with lead at 93 ug/l.

Organic contamination was not found in any residential wells although acetone was reported in one sample, likely introduced during sampling.

CONCLUSIONS AND OBSERVATIONS

Onsite soil investigations showed soil to be heavily contaminated, primarily with organic contaminants. Results of the hydrogeologic investigation have shown the existence of four hydrogeologic units in the area, a shallow saturated zone, a shallow sand and gravel aquifer, a clayey silt and silty clay zone, and a deep confined aquifer.

Migration of soil contaminants to the shallow saturated zone has occurred onsite as evidenced by high levels of contaminants in well 11A. Further leaching of soil contaminants to the saturated zone is expected to be slowed due to the presence of a compacted silty-clay cap on the northern half of

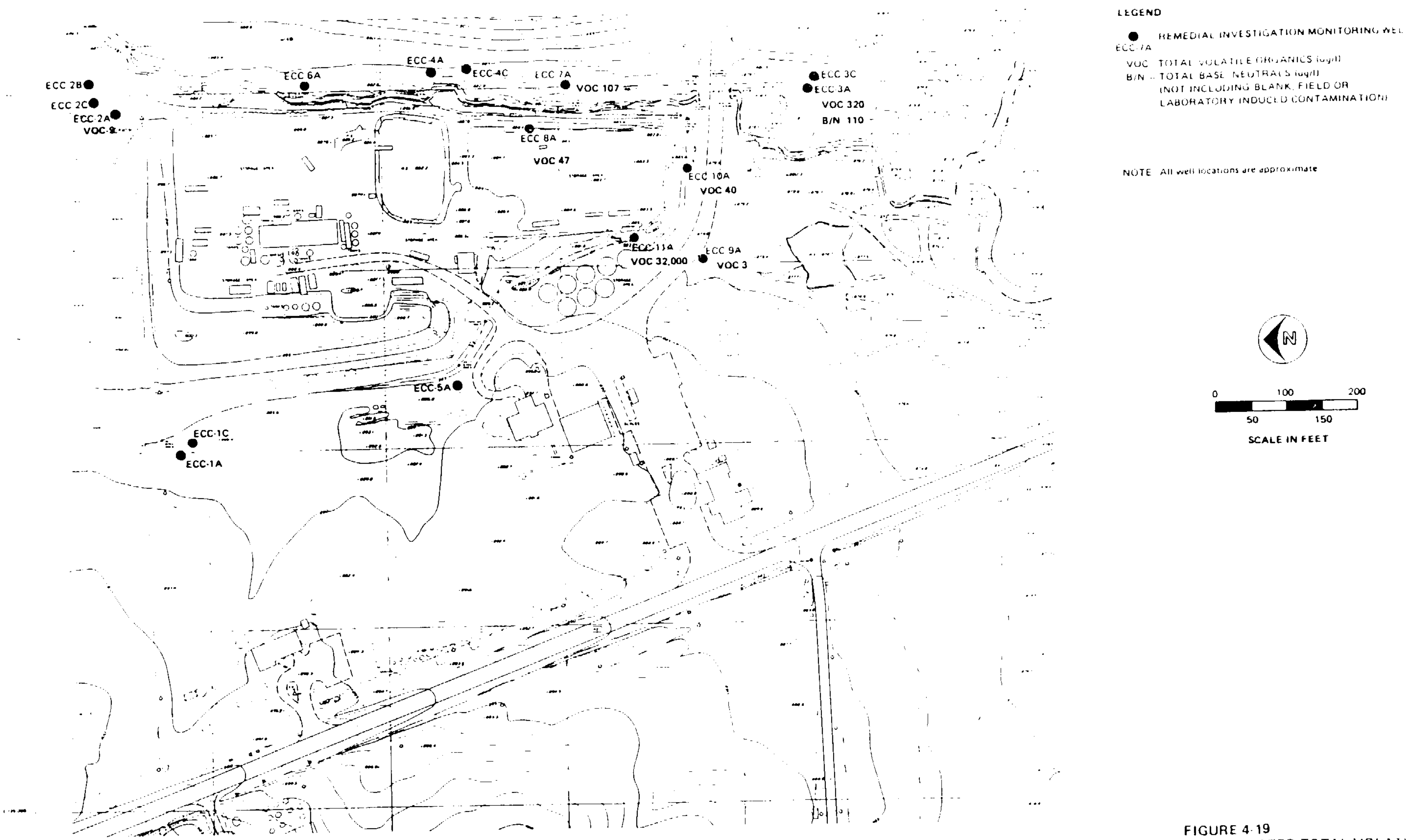
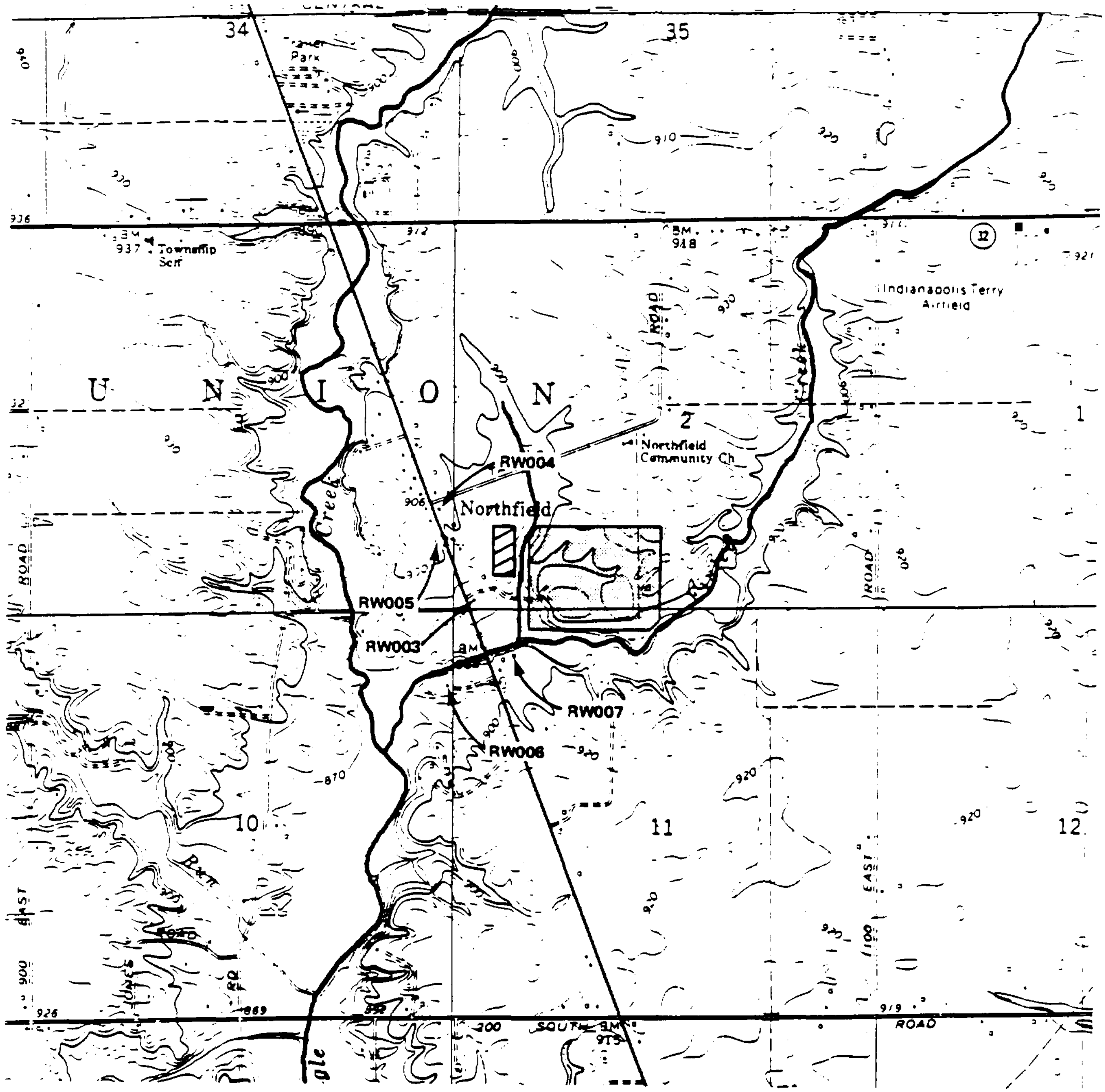


FIGURE 4-19
GROUNDWATER TOTAL VOLATILE ORGANICS AND TOTAL BASE/NEUTRAL CONCENTRATIONS (ug/l)
ECC RI REPORT



LEGEND

NORTHSIDE SANITARY LANDFILL

ECC SITE

0 2000 4000

SCALE IN FEET

FIGURE 4-20
RESIDENTIAL WELL
SAMPLING LOCATION
ECC RI REPORT

TABLE 4-15
RESIDENTIAL WELL INORGANIC RESULTS (ug/L)
ECC Site RI Report

COMPOUND	DETECTABLE LIMITS	QUALITY CRITERIA c	RW003 Bankert	RW004 Rousch	RW005 Jennings	RW005(duplicate) Jennings	RW006 Holly	RW007 Vandergriff	BLANK
Sample Location: / Well Name:			RW003 / Bankert	RW004 / Rousch	RW005 / Jennings	RW005(duplicate) / Jennings	RW006 / Holly	RW007 / Vandergriff	BLANK
ALUMINUM	200	—	482i	447i	[66]i	131i	[97]i	498i	406i
ANTIMONY	20	146 d	*	*	*	*	*	*	*
ARSENIC	10	50 j	25	28	[7]	23	[7]	24	10
BARIUM	100	1000 j	[9]	[5.5]	303	*	278	[2.4]	*
BERYLLIUM	5	0.0039 g	*	*	*	*	*	*	*
CADMIUM	1	10 j	*	*	*	*	*	*	*
CALCIUM	—	—	325i	410i	103000	348i	57200	171i	40
CHROMIUM	10	50 j	*	*	[3.6]	*	*	*	[4.5]
COBALT	50	—	*	*	*	*	[8.9]	[10.3]	*
COPPER	50	1000 e	*	*	[42]	*	*	*	[3]
IRON	50	300 e	[14]	[9.2]	3290	[11]	1110	*	[39]
LEAD	5	50 j	*	*	6.0	*	*	*	*
CYANIDE	10	200 d	*	*	*	*	*	*	*
MAGNESIUM	—	—	220	480	40900	245	26200	290	*
MANGANESE	10	50 e	*	*	133	*	33.9	*	*
MERCURY	0.2	0.014 d	*	*	*	*	*	*	*
NICKEL	40	13.4 d	[7]	[11]	[16]	[7.8]	[19.3]	[8]	*
POTASSIUM	—	—	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SELENIUM	2	10 j	*	*	*	*	*	*	*
SILVER	10	50 j	*	*	*	*	[7.7]	*	*
SODIUM	—	—	381000i	380000	15300	363000	31300i	260000	143000
THALLIUM	10	18 d	*	*	*	*	*	*	*
TIN	20	—	*	*	*	*	*	*	*
VANADIUM	200	—	*	*	*	*	*	*	*
ZINC	10	5000 e	*	*	134	*	49.2	*	*

FOOTNOTES:

a- QA data indicate the presence of these metal contaminants in the laboratory method blank
b- This metal was also detected in the analysis of the field blank.
c- U.S.EPA Drinking Water Quality Criteria or National Drinking Water Standards.
d- Water Quality Criteria for Human Health - Tocicity Protection (adjusted for consumption of water only.)
e- Secondary drinking water standard.
g- Water Quality Criteria for Human Health - U.S.EPA assigned carcinogen risk level of 10 -6 (for consumption of water only). One additional case of cancer in a population of 1,000,000.
h- No adverse effect level calculated by NAS/NRC.
i- Value has been corrected for the amount of contaminant in the lab blank.
j- Primary drinking water standard.
E- Value is estimated or not reported due to the presence of interference.
R- Spike sample recovery is not within control limits.
[]- Positive values less than the contract required detection limit.
N/A- Not analyzed for.
*- Less than laboratory detection limit (laboratory did not specify the limit)
— Criteria has not been established for this compound.

the site and the continued existence of the concrete pad on the south half of the site.

The shallow sand and gravel aquifer has been shown to be contaminated with inorganics and organics in well 7A and lesser amounts of organics in wells 8A and 10A. Because of the presence of the NSL site east of ECC, it cannot be definitively stated that the source of contamination in wells 3A and 7A is ECC though the contaminants are consistent with those found onsite. Organic contamination in wells 8A and 10A is likely due to onsite soils at ECC since they are directly downgradient of ECC contaminated soils and not NSL.

Contamination of the shallow sand and gravel aquifer may have occurred either via migration through the silty clay till onsite or through contaminated water and sediment in the former cooling water pond. As discussed perviously, the cooling pond intersected the shallow sand and gravel aquifer.

The deep confined aquifer below the site has not been found to be contaminated. Future migration of onsite contaminants to the deep aquifer is highly unlikely due to the upward vertical hydraulic gradient.

Migration of contaminants to the nearest residential wells surrounding the site is not indicated by the results of the residential well sampling.

SURFACE WATER AND SEDIMENTS

A well-developed drainage pattern exists in the area surrounding the ECC site. The principal surface drainage features are Eagle Creek and Finley Creek, an associated tributary. Two minor surface drainage features are adjacent to the site. An unnamed ditch flows south along the eastern site boundary and converges about 1,000 feet downstream from the site with Finley Creek. The other unnamed ditch flows southeast along the western and southern site boundaries before discharging near the southeast corner of the site, into the unnamed tributary of Finley Creek. Finley Creek converges with Eagle Creek about one-half mile southwest of the site. Eagle Creek then flows south for about 10 miles before discharging into the Eagle Creek Reservoir. The site is located outside the 100-year flood plain. Enclosed in Appendix C of this report are aerial photographs and a topographic map illustrating the area surrounding the ECC and NSL sites.

Natural surface water runoff from the area surrounding the site flows toward the unnamed tributary of Finley Creek or toward Finley Creek. The ECC site has been capped with clay as part of the surface cleanup activities. Surface water runoff from the northern part of the site largely flows south where a berm along the edge of the concrete pad redirects runoff west to the ditch. Runoff from the concrete pad flows south and is routed through a pipe at the southeast corner of the site and to the unnamed ditch. Before capping, runoff was directed to the cooling pond and occasionally overflowed to the unnamed ditch.

SCOPE AND METHODS

The purpose of the initial surface water and sediment sampling effort was to determine the extent of contamination in the unnamed ditch (east of the site), Finley Creek, and Eagle Creek. Previous ISBH and USGS sampling efforts have demonstrated contamination of surface water and sediment downstream from the ECC and NSL sites as shown in Chapter 3.

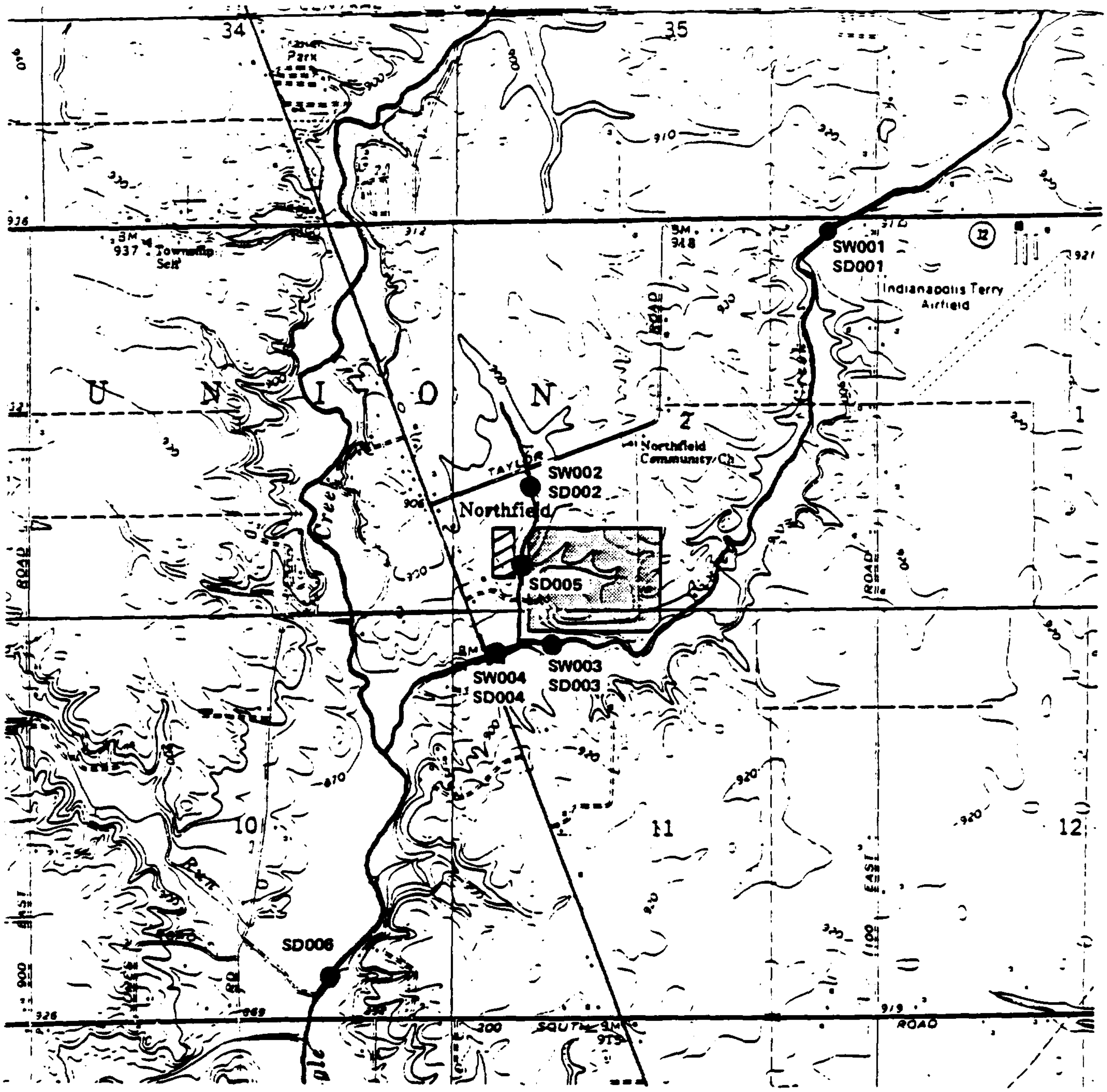
Four surface water samples and six sediment samples were taken on July 18, 1983, at locations in the unnamed ditch and Finley Creek identified in Figure 4-21. Surface water samples were collected at mid-depth of the stream with stainless steel dippers. Sediment samples were a composite of 6 to 14 cores from 1 to 3 inches long taken within a 10 foot square area. Details of sampling methods are described in Appendix A.

Three onsite surface water samples were collected on December 12, 1984, during the Phase 3 monitoring well sampling when sampling team members observed visibly contaminated water ponding on the clay cap onsite. The samples were collected from small areas of ponded water in the north half of the site (Figure 4-22). The site had been capped with 1 foot of clay previously. Sample bottles were filled by immersing in the ponded water. Inorganic samples were field filtered prior to preservation.

RESULTS

Surface water and sediment samples were analyzed for concentrations of pollutants in four categories: inorganics, volatile organics, base/neutrals, and pesticides and PCB's.

A summary of inorganic results for the surface water samples is presented in Table 4-16 and a summary of inorganic results for sediments is presented in Table 4-17. Inorganic surface water data show elevated concentrations of aluminum, iron and manganese at SW-002 in the unnamed ditch upstream of the ECC and NSL sites. All three of these constituents are at levels above water quality criteria or standards at this location as well as downstream of ECC and NSL at SW-003 and SW-004. Manganese was also found at elevated levels at all 3 onsite sample locations. Mercury was found at SW-003 and SW-004 though detection in the field blank indicates it to be a sampling or laboratory contaminant. In summary,



LEGEND

NORTHSIDE SANITARY LANDFILL

ECC SITE

SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS (APPROXIMATE)

0 2000 4000

SCALE IN FEET

FIGURE 4-21
SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS
ECC RI REPORT

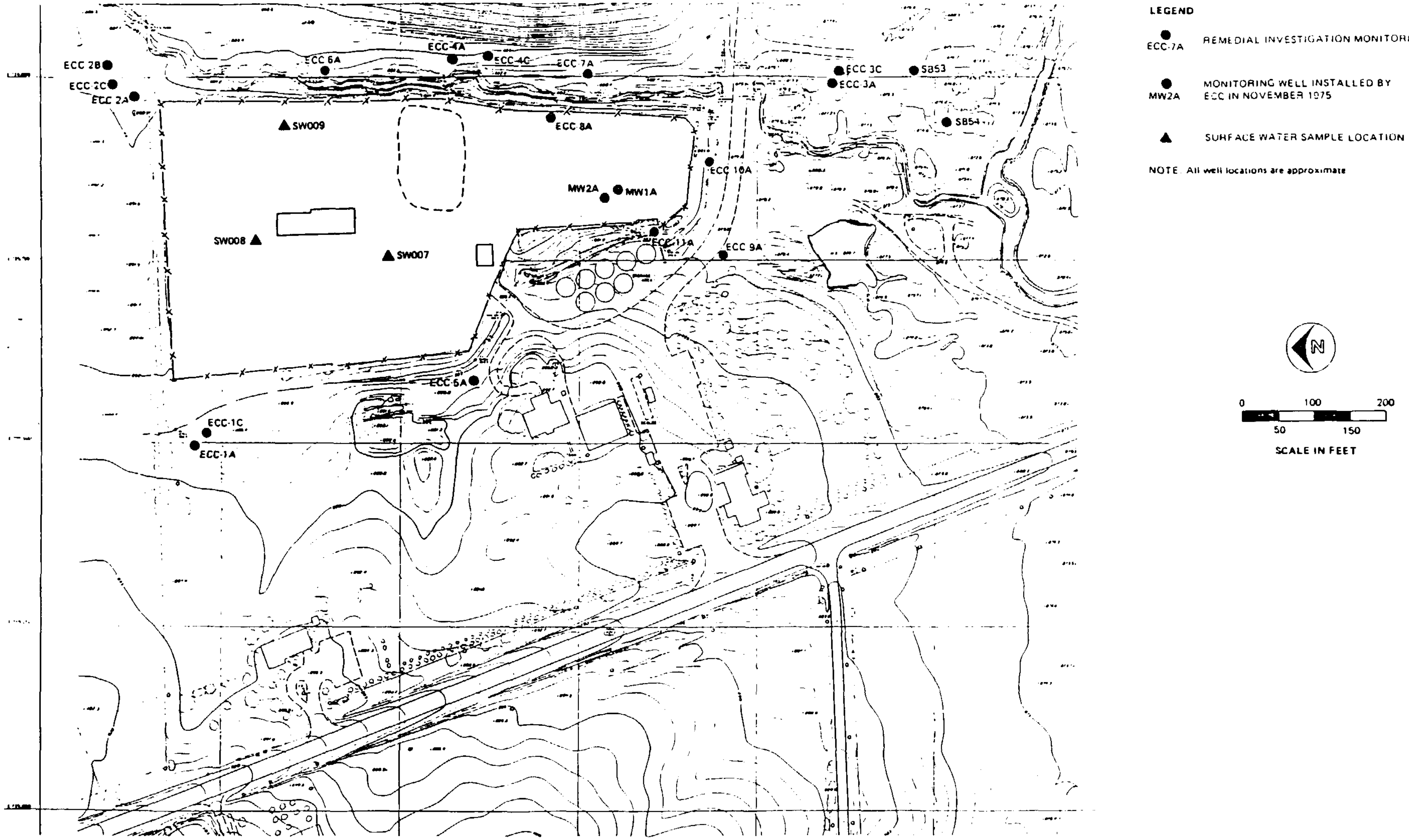


FIGURE 4-22
ONSITE SURFACE WATER
SAMPLE LOCATIONS
ECC RI REPORT

inorganic results do not show contamination of offsite surface water from either ECC or NSL at the locations sampled. Onsite inorganic contamination is limited to manganese.

Sediment inorganic results downstream of ECC showed only lead at concentrations above upstream levels. Lead was 48 mg/kg at SD-005 in the unnamed ditch whereas upstream of ECC and NSL it was 11.5 mg/kg. At location SD-005 the contaminant source could either be ECC or NSL.

Organic results are summarized in Tables 4-18 and 4-19 for the surface water and sediments, respectfully. Organic contamination of offsite surface water was limited to location SW-004. Compounds found at concentrations exceeding quantification limits were chloroethane, 1,1-dichloroethane, 1,1,1-trichloroethane, vinyl chloride, trans-1,2-dichloroethene and trichloroethene. Only 1,1-dichloroethane, vinyl chloride, and trichloroethene exceeded EPA water quality criteria at the 10^{-6} cancer risk level.

Five tentatively identified organic compounds were also found in SW-004, though only one compound was confirmed in the duplicate sample.

Three additional compounds (methylene chloride, o-xylene, and tetrachloroethene) were detected in surface water samples; however, concentrations were below quantifiable limits. Contamination of samples by methylene chloride is probably due to sample bottle contamination. Bis (2-ethylhexyl) phthalate was also detected in the upstream sample SW-002, but only in concentrations below the quantifiable limit.

Onsite ponded water was found to be contaminated with volatile and base/neutral compounds. All three locations showed contamination with location SW007 showing higher levels and more compounds. Several of the volatile compounds had also been detected at the offsite location SW-004. These were 1,1,1-trichloroethane, 1,2-transdichloroethene, tetrachloroethene and trichloroethene.

ECC site records and chemical analysis data are consistent with the ECC site as the source of contaminants identified at location SW-004. ECC site records report that chlorinated hydrocarbon solvents were processed at the facility. Further, drainage patterns direct over land flow from the vicinity of the ECC and NSL site towards sampling location SW-004. Sampling location SW-003 is approximately 750 feet upstream of location SW-004 on Finley Creek but receives runoff only from the NSL site. Surface water from this sampling location was not found to be contaminated by chlorinated hydrocarbons.

Table 4-18
ORGANIC ANALYTICAL RESULTS (UG/L)
SURFACE WATER SAMPLES
ECC SITE

Compound	SW-001 7/18/83	SW-002 7/18/83	SW-003 7/18/83	SW-004-01 7/18/83	SW-004-02 7/18/83	Blank 7/18/83	SW-007 12/12/89	SW-008 12/12/89	SW-009 12/12/89
Base/Neutral Compounds[a]									
4-chloro-3-methyl phenol							30[c]		
phenol							92		
2-methyl phenol							27		
4-methyl phenol							89		120
bis(2-ethylhexyl)phthalate		< 20							
di-n-octyl phthalate									17[c]
isophorone							240	87	86
Volatiles[b]									
1,1,1-trichloroethane				120	110		56	42	6
1,1-dichloroethane				45	45				
chloroethane				12	12				
1,2-transdichloroethene				330	330		34	6[c]	
methylene chloride	< 5	< 5	< 5	< 5	< 5	3,100	83	86	3[c]
tetrachlorethene				< 5	< 5		29	18	5[c]
trichloroethene				67	68		240	160	13
vinyl chloride				10	11				
ethyl benzene							13[c]		2[c]
toluene							82	26	6
acetone							1,100	220	30
2-butanone							560	150	16
total xylenes							47	16[c]	11
Nonpriority Pollutants/ Hazardous Substances									
o-xylene				< 5	< 5				
Tentatively Identified Compounds									
1,1,1-trichloro-1,2,2-trifluoroethane					13	14			
trichloroethene				6.9					
2,3,4-trimethylhexane				14					
2,4-dimethylheptane				22					
1,4-dioxane				10					
tetrahydrofuran						7.1			

[a] QA review identified base/neutral results of 7/18/83 samples as semiquantitative because the average surrogate recovery is <40 percent.
[b] QA review identified the volatile results of 7/18/83 samples acceptable due to good QA analytical results despite the fact that the analyses were run after expiration of the acceptable holding period.
[c] Indicates an estimated value.
Blank = not detected.

GLT360/21

Table 4-19
ORGANIC ANALYTICAL RESULTS
SEDIMENT SAMPLING
ECC SITE

Compound[a]	SD-001	SD-002	SD-003	SD-004[b]	SD-004[b] (Duplicate)	SD-005	SD-006	Blank
Base/Neutral Compounds								
bis(2-ethylhexyl)phthalate						912		
benzo(a)anthracene				440[c]				
benzo(a)pyrene				< 800[c]				
benzo(b)fluoranthene				< 800[c]				
benzo(k)fluoranthene				< 800[c]				
chrysene				440[c]				
benzo(ghi)perylene				< 800[c]				
dibenzo(a,h)anthracene				< 800[c]				
indeno(1,2,3-cd)pyrene				< 800[c]				
Volatiles								
methylene chloride	< 4.5	< 4.8	6.1	2.5	< 3	9.1	< 4.4	< 3.6
fluorotrichloromethane		< 4.8						
Nonpriority Pollutants/ Hazardous Substances								
benzoic acid				< 4,000				
4-methylphenol				960	680			
TENTATIVELY IDENTIFIED COMPOUNDS								
Base/Neutral Compounds[c]								
dichloromethane							170	
2-methyl-1-pentene							860	
1,3-dimethylbenzene			310					

[a]Concentrations expressed as ug/kg per dry unit weight except SD-004 and SD-004 duplicate.
[b]Concentrations reported per wet unit because sample quantities were insufficient to determine dry unit weight.
[c]Base/neutral analysis results were determined to be semiquantitative due to low recoveries in surrogate samples.

Organic sediment contaminants were limited primarily to the base/neutral and acid fractions. Contaminants above the quantifiable limit are:

- Methylene chloride at all locations
- Bis (2-ethylhexyl) phthalate at SD-005
- Benzo(a)anthracene at SD-004
- Chrysene at SD-004
- 4-methyl phenol at SD-004

Methylene chloride appeared in all samples including the blank and may be a sample bottle contaminant. SD-004 contaminants were not found in the duplicate sample with the exception of 4-methyl-phenol. The base/neutral contaminants found at SD-004 were not found in any of the Phase 1 or 2 onsite soil samples. As a result it is not believed that ECC is the source of this potential contamination.

CONCLUSIONS AND OBSERVATIONS

From the analysis of these results, the following conclusions are drawn:

- Surface water runoff from the ECC site is directed towards the unnamed tributary of Finley Creek or towards Finley Creek.

- Inorganic contamination of surface water does not appear to be occurring offsite in the vicinity of ECC.

- Inorganic sediment contamination in the vicinity of ECC is limited to lead in the unnamed ditch.

- Organic contamination of offsite surface water is limited to location SW-004. Contaminants consist almost entirely of chlorinated hydrocarbons.

- Surface water ponded on the clay onsite was found to be contaminated with a variety of base/neutral and volatile compounds.

- ECC site records and chemical analysis data are consistent with the ECC site as a source of organic contaminants detected in location SW-004.

- Organic contamination of sediments possibly resulting from the ECC site was found at SD-005 (bis(2-ethylhexyl)phthalate) in the unnamed ditch and SD-004 in Finley Creek (4-methylphenol).

GLT424/104

Chapter 5
CONTAMINANT MIGRATION AND FATE

INTRODUCTION

This chapter is divided into two sections: general discussion of the present and potential pathways of contaminant migration in terms of the possible receptors; and a discussion of the migration and fate of contaminants at the ECC site. Due to the large number of contaminants found onsite, specific indicator chemicals were chosen as representative of the range of contaminants based on concentration, migration potential, degradation rates, toxicity, and carcinogenicity. The indicator chemicals chosen are listed in Table 5-1. Methylene chloride is included as an indicator even though it was found in groundwater blank samples because of the high levels found in soil samples.

POTENTIAL PATHWAYS OF MIGRATION

CONTAMINANT SOURCE

As a result of initial remedial measures, the original sources of contamination at the ECC site have been eliminated. The current source at the site is the subsurface soil which contains high concentrations of organic compounds as described in Chapter 4.

PATHWAYS

Figure 5-1 illustrates the potential pathways for contaminant migration.

Onsite Soils

Although the ECC site was covered with a clay cap upon completion of surface cleanup activities, samples from ponding surface water indicated the presence of organics. Though soil samples of the cap were not analyzed as part of the RI, it is presumed they are contaminated with the organics detected in the ponding surface water samples. The clay that was used to cap the ECC site was obtained from borrow areas at NSL. One soil sample of the borrow material was analyzed for volatile organic priority pollutants and heavy metals, as part of the emergency response effort. The results of borrow material analysis is presented in Table 5-2. These contaminants could volatilize or be transported as dust particles entrained by wind or transported in surface water runoff. Below the cap, heavily contaminated soil could be a risk to receptor populations since any future excavation might bring contaminants to the surface. Once chemicals are at the surface, receptors (plants and wildlife, as well as

Table 5-1
INDICATOR CHEMICALS AT ECC

Chloroform

Methylene Chloride

1,1,2-Trichloroethane (1,1,2 TCA)

1,1,1-Trichloroethane (1,1,1 TCA)

Trichloroethene (TCE)

Tetrachloroethene (PCE)

Ethylbenzene

Toluene

Phenol

PCB's

Bis(2-ethylhexyl)phthalate

Di-n-butyl phthalate

Diethyl phthalate

Dimethyl phthalate

GLT301/58

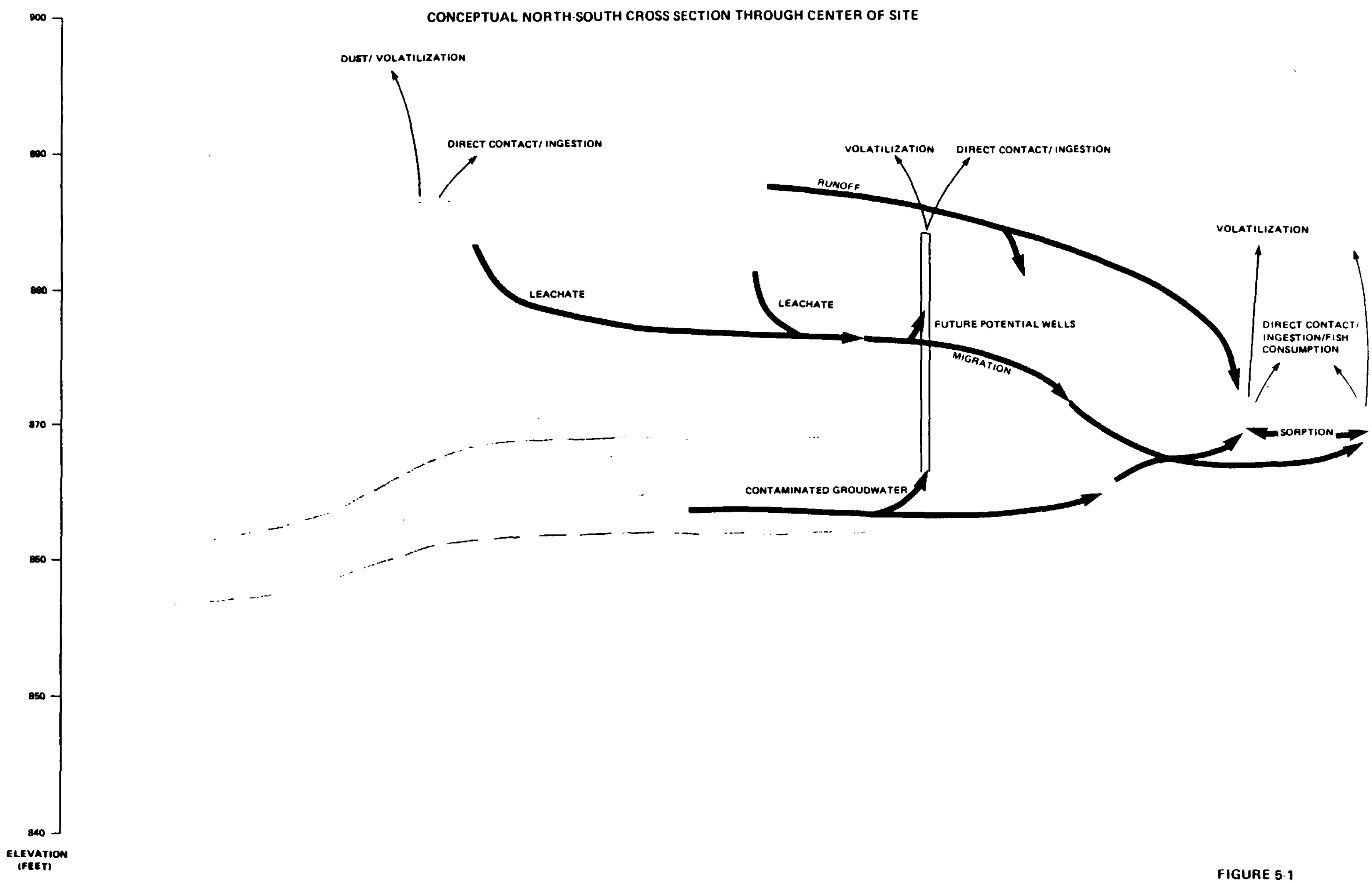


FIGURE 5-1
POTENTIAL PATHWAYS FOR CONTAMINANTS MIGRATION
ECC RI

Table 5-2
SOIL ANALYSIS OF BORROW MATERIAL USED TO
CAP THE ECC SITE IN NOVEMBER, 1984

Compound	Concentration (ug/kg)
Benzene	16
Carbon tetrachloride	44
Ethylbenzene	16
Toluene	31
	Concentration (mg/kg)
Cadmium	1.5
Nickel	30
Copper	13
Chromium	8
Zinc	50
Lead	7.3
Antimony	≤2.5
Silver	≤0.5
Beryllium	≤0.25
Mercury	≤0.015
Arsenic	≤7
Selenium	≤7
Thallium	≤2.5

GLT360/99

humans) may be subject to inhalation, ingestion and direct contact of harmful compounds.

Transport of contaminants from onsite soils is also likely through leaching. As water infiltrates through the contaminated soil, it will desorb many compounds and eventually leach into the groundwater in the shallow saturated zone. This is presently the case as the groundwater samples from the shallow saturated zone were found to be contaminated with volatile organics.

Groundwater

Once contaminants have entered the groundwater, several pathways of migration are possible. As mentioned previously in this report, four hydrologic units are located under the ECC site. In the past, contaminants could potentially migrate downwards from the shallow saturated zone and contaminate the lower sand and gravel aquifer. Low level contamination found in the shallow sand and gravel aquifer onsite indicates that this probably has occurred. Alteration of site characteristics during surface cleanup, however, has made this an unlikely migration pathway presently or in the future. The cooling pond, which was hydrologically connected to the shallow sand and gravel aquifer, has been cleaned of contaminated water and the majority of contaminated sediments, and backfilled with clean fill material. Onsite ponding water has also been removed, thus eliminating the downward vertical gradient. Water can no longer pond onsite, and vertical gradients between the shallow saturated zone and the shallow sand and gravel aquifer are upward. However, future excavation at the site could cause ponding of water onsite and reverse the gradient and enable downward migration of contaminants into the shallow sand and gravel aquifer. Also, some contaminated sediments remain in the cooling pond and may cause continued contamination of the sand and gravel aquifer.

Evidence of downward migration of contaminants from the shallow sand and gravel to the deep confined aquifer was not found and is highly unlikely now or in the future due to the upward vertical gradient. Existing low level contaminants in the shallow sand and gravel aquifer will likely migrate south and discharge to the unnamed ditch or Finley Creek. Receptors could potentially contact the groundwater if potable wells are constructed within the zones of contamination.

In summary, the most probable pathways for contaminant transport in the groundwater are through migration from the shallow saturated zone or from the shallow sand and gravel aquifer to the unnamed ditch or Finley Creek.

Surface Waters

Both the unnamed ditch and Finley Creek receive groundwater and surface water runoff from the ECC site. Contaminants in the surface water may volatilize, precipitate or adsorb in sediments, or remain in solution and be transported downstream to Big Eagle Creek and eventually the Eagle Creek Reservoir. Receptors may be exposed by wading in the creek, ingesting contaminated water, or ingesting fish which have bioaccumulated contaminants.

Sediments

Contaminants within stream sediment may dissociate and reenter solution or may be scoured and resuspended in high flow and carried downstream. During low flow periods contaminated sediments may be exposed along the stream banks and may be transported as dust.

MIGRATION AND FATE OF INDICATOR CHEMICALS

Given the nature of contamination at ECC and the potential pathways of migration, indicator chemicals were assessed in terms of their behavior in soils, groundwater, and aquatic systems. Emphasis was placed on the mobility and persistence of each chemical. Mobility is important because it determines the rate of chemical migration away from the site. Persistence is important because it determines if a chemical will remain in the environment long enough to reach a receptor.

CHARACTERIZATION OF INDICATOR CHEMICALS

Table 5-3 lists some of the important physical-chemical properties of each indicator chemical. No inorganics were selected as indicators since only cadmium, lead, and zinc were found at concentrations above typical ranges in more than one sample. Considering the soils characteristic of the site and the physical-chemical properties of the inorganics, transport will be minimal.

It is important to note that the actual migration and fate of the contaminants depend largely on the physical-chemical features of the site such as temperature, pH, percent soil moisture, geochemistry, soil type, and oxidation-reduction potential. Other factors that must be considered are potential reactions between chemicals and the formation of transformation byproducts. For example, under certain conditions tetrachloroethene is believed to breakdown to trichloroethene, and then to the "cis" form of dichloroethene and then to vinyl chloride. Each of the byproducts are compounds that would pose a health threat to receptors. It is beyond the scope of this project to research the migration and fate of

Table 5-3
PHYSICAL-CHEMICAL PROPERTIES OF INDICATOR ORGANICS

	Molecular Weight	Boiling Point (°C)[a]	Vapor Pressure (torr)[b]	Solubility (mg/L)	Log Kow[c]	Kd[e]
Volatile Organics						
1,1,2-trichloroethene	133.41	133.8	19[d]	4,500[d]	2.17	0.18
1,1,1-trichloroethane	133.41	74.1	97.0[d]	480-4,400[d]	2.17	0.18
Tetrachloroethene	165.83	121.0	14.0[d]	150-200	2.88	0.94
Trichloroethene	131.39	87.0	57.9[d]	1,100	2.29	0.24
Toluene	92.13	110.6	28.7[d]	535[f]	2.69	0.60
Chloroform	119.38	61.7	150.5[d]	8,200[f]	1.97	0.12
Methylene chloride	84.99	39.8	350.0[d]	20,000[f]	1.25	0.022
Ethylbenzene	106.2	136.2	7[d]	152[d]	3.15	1.74
Acid Compounds						
Phenol	94.11	181.8	0.8[f]	93,000[f]	1.46	0.036
Base/Neutral Compounds						
Bis(2-ethylhexyl)phthalate	391.0	386.9	0.01[d]	1.3[f]	8.7	660,000
Dimethyl phthalate	194.2	282.0	0.01[d]	896[f]	2.12	0.16
Diethyl phthalate	222.2	298.0	0.05[h]	4,320[f]	3.22	2.05
Di-n-butyl phthalate	278.3	340.0	0.1[g]	13	5.2	195
Other Organics						
PCB 1260	375.7	-	4.05×10^{-5}[f]	0.0027	7.14	17,000
1232	232.2	-	4.06×10^{-3}[f]	1.45	3.2	1.95

[a] Boiling point at 760 torr.
[b] torr = 1 mm of mercury (Hg).
[c] Kow = octanol-water partition coefficient.
[d] Vapor pressure/solubility at 20°C.
[e] K_d = soil-water partition coefficient
[f] Vapor pressure/solubility at 25°C.
[g] Vapor pressure/solubility @ 115°C
[h] Vapor pressure/solubility @ 70°C.

GLT301/60

all the byproducts; however, their significance should be recognized.

Table 5-4 provides a summary of the environmental behavior of the indicator organic compounds. Summaries are provided for three key sectors of the environment: subsurface soils and groundwater, surface soils, and aquatic systems. Potential transformation and transfer mechanisms are listed for each indicator chemical. Transformation mechanisms act to change the form of a chemical, while transfer mechanisms partition the chemical between media (e.g., volatilization is a water-air transfer; sorption is a water-soil transfer). The persistence of a chemical in a given sector of the environment is generally controlled by transformation mechanisms and volatilization. Chemical mobility in a given sector is mainly controlled by sorption. Both tables list if the mechanism has a significant (S), insignificant (I), or moderate (M) impact on behavior. In cases where the significance is uncertain or dependent on environmental conditions, the mechanism is denoted as possible (P).

Environmental behavior profiles are provided in Appendix C for each indicator chemical. The following section summarizes site characteristics important to contaminant transport.

KEY SITE CHARACTERISTICS

Groundwater

The key site characteristics are rate of leachate flow to the shallow saturated zone and travel time of groundwater from the site to both the unnamed ditch and Finley Creek. Using an estimated 7.8 inches of recharge water per year to the shallow saturated zone, the leachate rate was calculated as 568 gallons per year per square foot (200 liters/per year per square meter). Groundwater velocities for the shallow saturated zone were calculated assuming flow from the eastern portion of the site is directed to the unnamed ditch and that flow from the northern and western portions is directed to either the unnamed ditch or Finley Creek. The average horizontal gradient for the eastern portion was estimated to be 0.05 feet per foot and for the northwestern portion to be 0.02 feet per foot. An effective porosity of 0.10 was used and the average hydraulic conductivity was estimated as 10^{-5} centimeters per second. The resulting groundwater velocities are 1.0 ft/yr for the northwestern portion and 2.6 ft/yr for the eastern portion. Contaminant velocities and travel times were then calculated using retardation factors.

In the shallow sand and gravel aquifer, the average hydraulic conductivity was estimated to range from 10^{-2} to 10^{-3} centimeters per second and the porosity was assumed to be 0.30. Using an average gradient of 0.03 feet per foot, the

Table 5-4 (Page 1 of 2)
SUMMARY OF ENVIRONMENTAL BEHAVIOR OF INDICATOR ORGANIC COMPOUNDS IN
SUBSURFACE SOILS, GROUNDWATER, SURFACE SOILS AND AQUATIC SYSTEMS

	Subsurface Soils and Groundwater				Surface Soils					
	Transformation			Transfer	Transformation				Transfer	
Compound	Oxidation	Hydrolysis	Biodegradation	Sorption	Oxidation	Hydrolysis	Photolysis	Biodegradation	Volatilization	Sorption
1,1,1-Trichloroethane	I	6 mos - 1 yr	P[a]	I	I	P	I	I	S	I
1,1,2-Trichloroethane	I	6 mos - 1 yr	P[a]	I	I	P	I	I	S	I
Tetrachloroethene	8.8 mos	I	P[a]	I	P	I	I	I	S	I
Trichloroethene	10.7 mos	I	P[a]	I	P	I	I	I	S	I
Toluene	I	I	P[b]	I	P	I	P	P[b]	S	I
Chloroform	I	1-3,500 yrs	P[a]	I	I	P	I	P[a]	S	I
Methylene Chloride	I	1-704 yrs	P	I	I	P	I	P	S	I
Ethylbenzene	I	I	P	I	P	I	P	P	S	I
Polychlorinated Biphenyls	I	I	days-mos[b,e]	S	I	I	P[e]	days-mos[e]	mos-yrs	S
Phenol	I	I	S	I	P	I	P	S	P	I
Phthalates	I	I	P	S[f]	I	P	I	P	I	S[f]

Notes: S = Significant

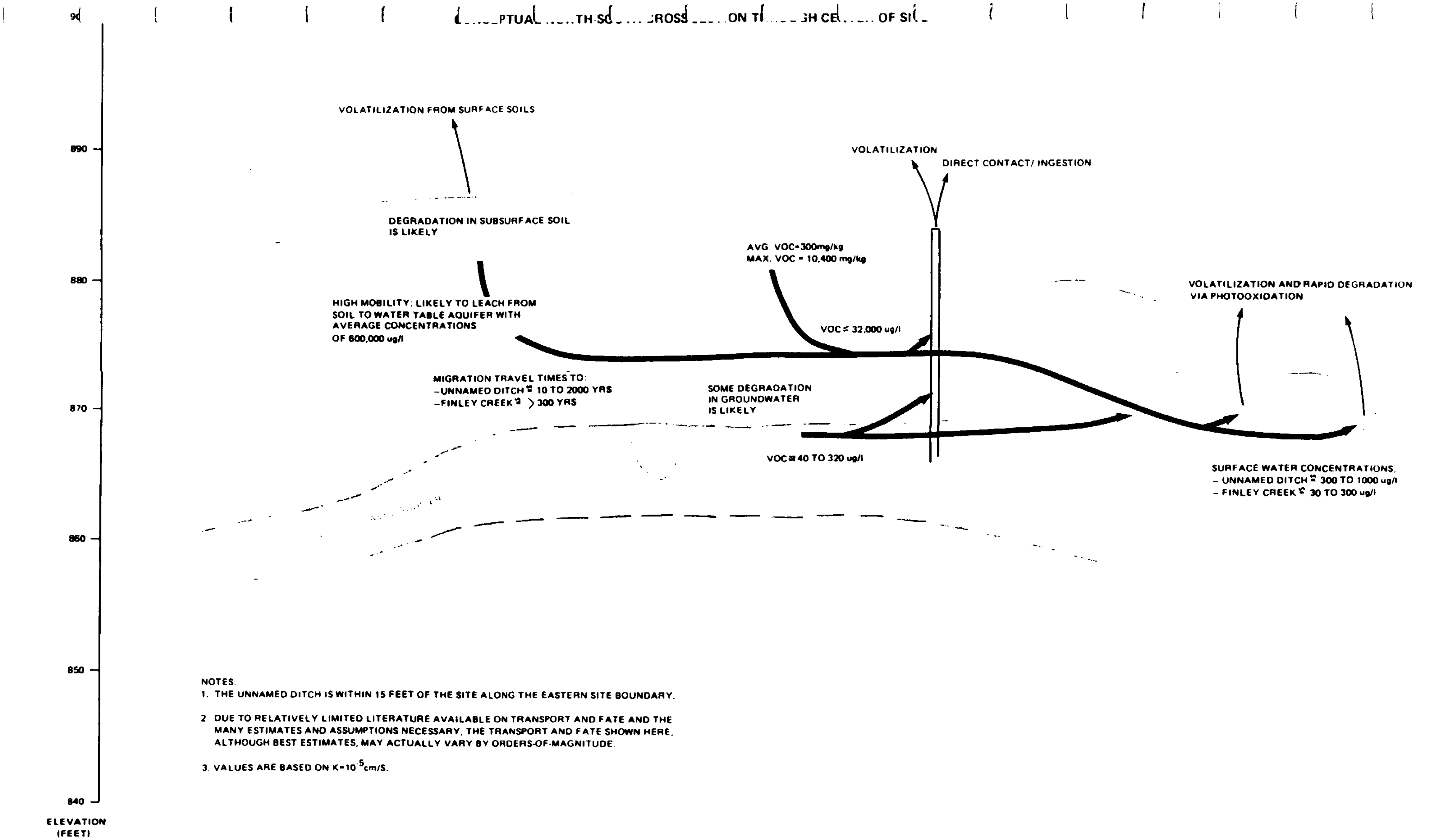
I = Insignificant

M = Moderate

P = Possible

[a]Under anaerobic conditions.
[b]Under aerobic conditions.
[c]Clear, well aerated systems.
[d]Waters high in iron and copper.
[e]Depends on degree of chlorination.
[f]Depends on the compound.

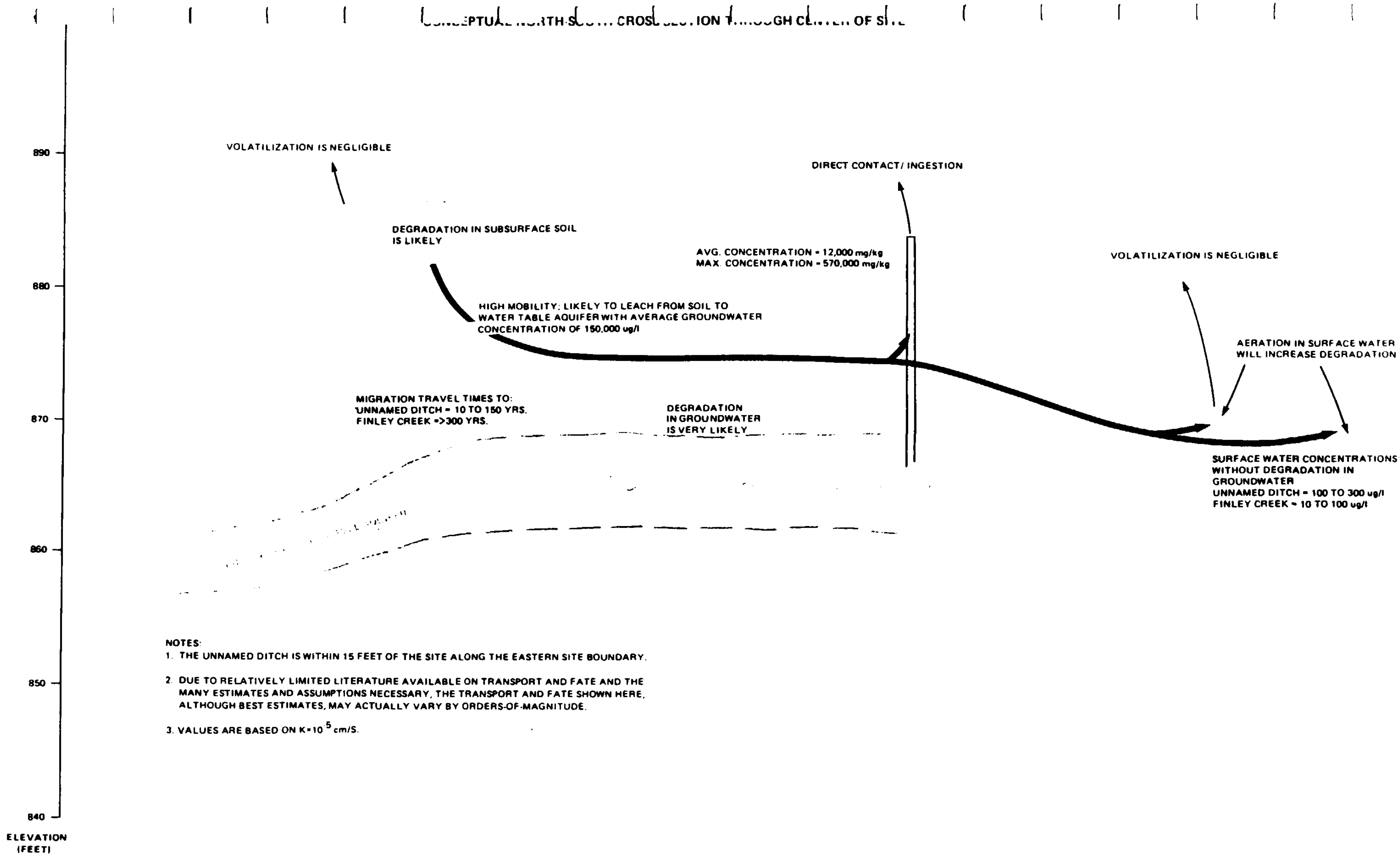
GLT301/59-1



NOTES:

1. THE UNNAMED DITCH IS WITHIN 15 FEET OF THE SITE ALONG THE EASTERN SITE BOUNDARY.
2. DUE TO RELATIVELY LIMITED LITERATURE AVAILABLE ON TRANSPORT AND FATE AND THE MANY ESTIMATES AND ASSUMPTIONS NECESSARY, THE TRANSPORT AND FATE SHOWN HERE, ALTHOUGH BEST ESTIMATES, MAY ACTUALLY VARY BY ORDERS-OF-MAGNITUDE.
3. VALUES ARE BASED ON $K = 10^{-5}$ cm/S.

FIGURE 5-2
TRANSPORT AND FATE OF VOLATILE ORGANICS
ECC RI



NOTES:

1. THE UNNAMED DITCH IS WITHIN 15 FEET OF THE SITE ALONG THE EASTERN SITE BOUNDARY.
2. DUE TO RELATIVELY LIMITED LITERATURE AVAILABLE ON TRANSPORT AND FATE AND THE MANY ESTIMATES AND ASSUMPTIONS NECESSARY, THE TRANSPORT AND FATE SHOWN HERE, ALTHOUGH BEST ESTIMATES, MAY ACTUALLY VARY BY ORDERS-OF-MAGNITUDE.
3. VALUES ARE BASED ON $K=10^{-5}$ cm/S.

FIGURE 5-3
TRANSPORT AND FATE OF PHENOLS
ECC RI

Phthalates

Phthalate esters in the subsurface soil are already below acceptable levels. The phthalates found at ECC exhibit a range of physical-chemical properties. Bis(2-ethylhexyl) phthalate and di-n-butyl phthalate both have low solubilities and high soil-water partition coefficients. Diethyl and dimethyl phthalate have much higher solubilities and much lower partition coefficients. Consequently, the latter two exhibit some mobility within the environment and will leach from the contaminated soil into the groundwater. Only trace concentrations of bis(2-ethylhexyl)phthalate and di-n-butyl phthalate will appear in the groundwater:

	Concentration (ug/l)	
	Average	Maximum
Diethyl phthalate	100	2,000
Dimethyl phthalate	200	4,000
Di-n-butyl phthalate	1	20
Bis(2-ethylhexyl)phthalate	0.01	0.3

Estimated travel times from the eastern portion of the site to the unnamed ditch range from 20 to 75 years for dimethyl and 150 to 500 years for diethyl phthalate using 10^{-5} cm/sec. Travel times for the northwestern portion of the site are orders of magnitude higher.

Degradation will most likely occur since biodegradation is a significant mechanism in the ultimate fate of the phthalate esters. However, concentrations in the unnamed ditch are estimated to be less than 8 ug/l assuming no degradation. Estimated concentrations in Finley Creek are even lower and will be reduced considerably if degradation is considered.

Volatilization of phthalates will not be a significant pathway since they have very low vapor pressures. Phthalates should not be able to migrate to surface water sediments except in trace quantities unless there is direct runoff or discharge to the creek. Once in the surface water the phthalates will adsorb readily and tend to persist in the sediments. Figure 5-4 summarizes the transport and fate of phthalates at ECC.

PCB's

PCB's will tend to persist in surface and subsurface soils. Some degradation may occur in onsite surface soils through volatilization, photolysis, and biodegradation. Subsurface degradation will be limited and (as with surface soils) will vary with the type of PCB mixture.

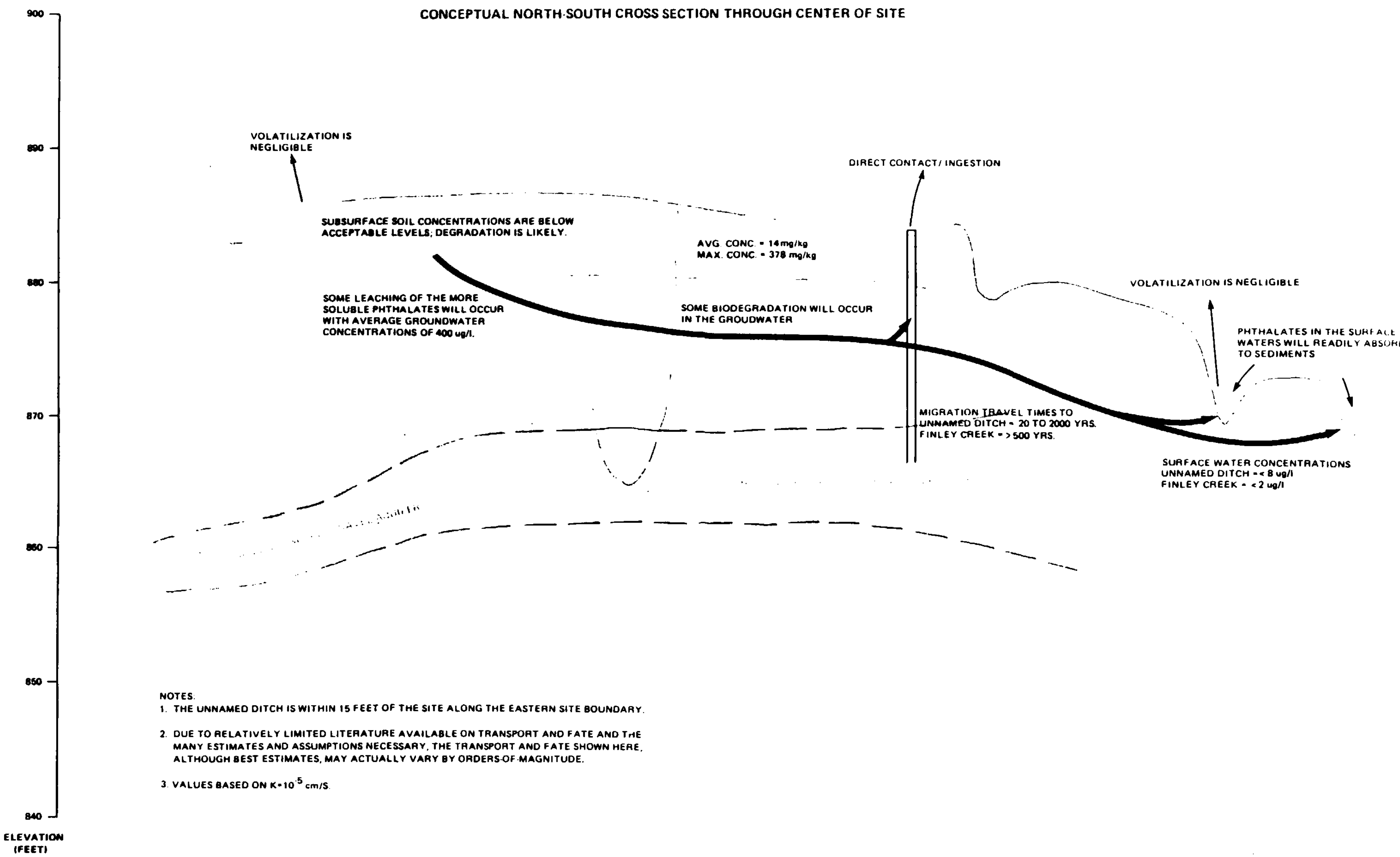
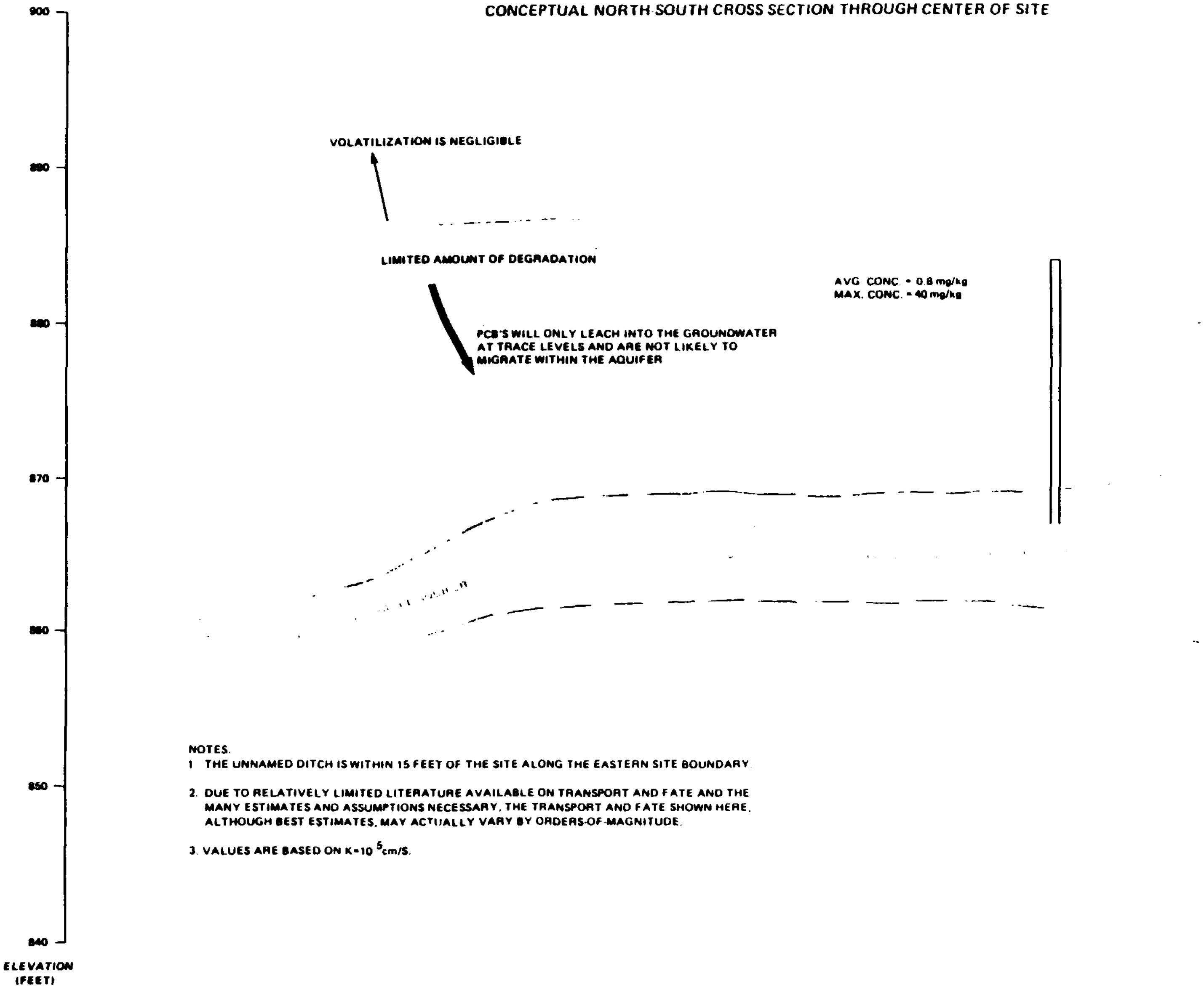


FIGURE 5-4
TRANSPORT AND FATE
OF PHTHALATES
ECC RI

PCB's readily adsorb to soil and have low solubilities. Of the two detected at ECC, only 1232 will leach into the groundwater and only in trace concentrations (50 ug/l based on average soil concentrations). PCB's are, however, not likely to migrate within the aquifer. If PCB's enter the ditch or creek by surface runoff or direct discharge, they would absorb readily to the sediments. Figure 5-5 summarizes the transport and fate of PCB's at ECC.

GLT301/57

CONCEPTUAL NORTH-SOUTH CROSS SECTION THROUGH CENTER OF SITE



NOTES.

1. THE UNNAMED DITCH IS WITHIN 15 FEET OF THE SITE ALONG THE EASTERN SITE BOUNDARY.
2. DUE TO RELATIVELY LIMITED LITERATURE AVAILABLE ON TRANSPORT AND FATE AND THE MANY ESTIMATES AND ASSUMPTIONS NECESSARY, THE TRANSPORT AND FATE SHOWN HERE, ALTHOUGH BEST ESTIMATES, MAY ACTUALLY VARY BY ORDERS-OF-MAGNITUDE.
3. VALUES ARE BASED ON K=10 ^{5}cm/S.

FIGURE 5-5
TRANSPORT AND FATE
OF PCB'S
ECC RI

Chapter 6
ENDANGERMENT ASSESSMENT

INTRODUCTION

This endangerment assessment analyzes the potential human health and environmental impacts of the ECC site in the absence of any remedial action (the no action alternative). It has two components, the public health evaluation and environmental assessment, which are discussed relative to each of the appropriate environmental media: soil, sediment, groundwater and surface water. Potential receptors are identified along with the hazardous substances present the environmental media. Both the quantitative and qualitative impact of contaminants on the public health and the environment are evaluated.

PURPOSE

An endangerment assessment is a determination of the magnitude and probability of actual or potential harm to public health, welfare, or the environment by the threatened or actual release of a hazardous substance. Before taking action under Section 106 of CERCLA to abate the hazards or potential hazards at a site, the EPA must be able to properly document and justify its assertion that an imminent hazard exists. The endangerment assessment provides this documentation and justification.

DEFINITION OF PROBLEM

Earlier chapters of this report have shown that environmental media at the ECC site have become contaminated with over 80 organic and inorganic chemicals (Table 6-1). The potential human health effects associated with exposure to many of these chemicals affect a range of human organ systems including the respiratory, nervous, circulatory, digestive, dermal, and urinary systems. Fourteen of the chemicals found at this site are potential human carcinogens (Table 6-2).

Chapter 5 of this report discusses the environmental fate and transport of site contaminants. The primary releases will be from soil to groundwater and then to surface water.

The population at risk consists of current and future human, plant, and wildlife populations residing on or adjacent to the ECC site. These populations are defined in greater detail in the public health evaluation and the environmental assessment in sections of this chapter.

Table 6-1 (Page 1 of 3)
SUBSTANCES DETECTED AT ECC DURING THE REMEDIAL INVESTIGATION

Compound	Soils	Sediments	Groundwater	Offsite Surface Waters
VOLATILES				
Benzene			XS	
Chlorobenzene	X			
1,1,1-Trichloroethane	X		S	S
1,1-Dichloroethane	0		0	0
1,1,2-Trichloroethane	X			
Chloroethane			0	0
Chloroform	X		XS	
1,1-Dichloroethene	X		XS	
Trans-1,2-Dichloroethene	0		S	S
Trans-1,3-Dichloropropene	X		0	
Ethylbenzene	X		XS	
Methylene Chloride	X		XS	
Fluorotrichloromethane		X		
Tetrachloroethene	X		XS	XS
Toluene	X		XS	S
Trichloroethene	X		XS	XS
Vinyl chloride	X		XS	
Acetone	0		0	
2-Butanone (MEK)	0		0S	
4-Methyl-2-Pentanone	0			
Styrene			0	
o-Xylene	X		S	0
2-Hexanone	0			
p-Chloro-m-Cresol				
Phenol	X			
Benzoic Acid	0	0		
2-Methylphenol	0			0
4-Methylphenol	0	0		0
BASE/NEUTRALS				
1,2-Dichlorobenzene	0			
Fluoranthene			XS	
Isophorone	X			

X = Substances quantitatively assessed for risk in endangerment assessment.
0 = Substances not quantitatively assessed because a cancer potency or acceptable daily intake value is not available.
S = Substance compared to standard, criteria, or guideline.

Table 6-1 (Page 2 of 3)

Compound	Soils	Sediments	Groundwater	Offsite Surface Waters
Naphthalene	0		XS	
bis(2-Ethylhexyl) Phthalate	X	X	XS	
Benzyl Butyl Phthalate	0			
di-n-Buyl Phthalate	X			
di-n-Octyl Phthalate	0			0
Diethyl Phthalate	X		XS	
Dimethyl Phthalate	X			
Crysene	0		S	
Benzo(ghi) Perylene	0			
Fluorene	0			
Phenanthrene	0			
Pyrene			S	
2-Methylnapththalene	0			
PCB'S/PESTICIDES				
PCB-1232	X			
PCB-1260	X			
INORGANICS				
Antimony	X	X	XS	
Arsenic	X	X	S	
Aluminum	0	0	0	0
Barium	0	0	S	
Berylium	X	X		
Cadmium	X	X		
Cobalt	0	0	0	
Calcium	0		0	
Chromium	X	X	XS	
Copper	0		S	
Iron	0	0	S	0
Lead	X	X	XS	
Magnesium			0	

X = Substances quantitatively assessed for risk in endangerment assessment.
0 = Substances not quantitatively assessed because a cancer potency or acceptable daily intake value is not available.
S = Substance compared to standard, criteria, or guideline.

Table 6-1 (Page 3 of 3)

Compound	Soils	Sediments	Groundwater	Offsite Surface Waters
Manganese	0	0	S	0
Potassium				
Sodium			0	
Nickel	X	X	XS	
Selenium		X	XS	
Mercury	X	X	XS	
Silver		X	X	
Thallium		X	XS	
Tin		0		
Vanadium	0	0		
Zinc		X	S	
Cyanide	X	X		

X = Substances quantitatively assessed for risk in endangerment assessment.
0 = Substances not quantitatively assessed because a cancer potency or acceptable daily intake value is not available.
S = Substance compared to standard, criteria, or guideline.

GLT412/30

Table 6-2
POTENTIAL CARCINOGENS DETECTED AT ECC

	Carcinogen By U.S. EPA Carcinogen Assessment Group[a]	International Agency for Research on Cancer Category[b]			
		1	2A	2B	3
Benzene	X	X	X	X	X
1,1,2-Trichloroethane	X				X
Chloroform	X			X	
1,1-Dichloroethene	X				X
Methylene Chloride	X				X
Tetrachloroethene	X				X
Trichloroethene	X				X
Vinyl chloride	X	X			
PCB (Total)	X			X	
Arsenic	X	X			
Beryllium[c]	X		X		
Cadmium[c]	X		X		
Chromium[c]	X	X			
Nickel[c]	X			X	

[a]Potencies set by U.S. EPA Carcinogen Assessment Group (CAG) (U.S. EPA, Dec. 1984).
[b]International Agency for Research on Cancer Classification (WHO 1982):
- 1 - Human carcinogen
- 2A - Probable human carcinogen, positive animal carcinogen with limited evidence of human carcinogenicity.
- 2B - Probable human carcinogen, positive animal carcinogen with insufficient data on human carcinogencity.
- 3 - Data inadequate to be classified as to carcinogenicity in humans.

[c]Carcinogen by inhalation route only.

GLT360/71

Human exposure to contaminants is dependent on the environmental media in which the contaminant is present and the current and future use of the site and adjacent property. Contact with contaminants by natural population is governed by the environmental media contacted and the habitat and range of the population. The potential exposure pathways at ECC are listed in Table 6-3.

PUBLIC HEALTH EVALUATION

INTRODUCTION

The intent of the public health evaluation is to identify potential threats to human health in the absence of remedial action. It is assumed that the site has the potential for unrestricted future development under the no action alternative. This public health evaluation section characterizes the population at risk, describes the risk assessment approach, and presents summaries of the public health risk by media. Appendix E presents the risk assessment by media in greater detail.

Population at Risk

The ECC site is in Union Township of Boone County, Indiana. The 1982 population of Union Township was 1,827. There are no population projections available for Union Township at present, however, based on past trends the population of Union Township could double by the year 2000. The zoning for the area around the site is shown in Figure 6-1.

There are approximately 30 residences within a ½ mile radius of the ECC site. Assuming development of 1 acre lots, the number of residences within a ½ mile radius of the ECC site could increase to around 300. There are currently no hospitals, schools, or nursing homes in the immediate area. Residents could become potentially at risk if they contacted contaminated soil, groundwater, surface water or biota on or adjacent to the ECC site. Exposure will be limited by location of residence (example: upgradient versus down gradient from site), lifestyle (example: fishing versus not eating fish), and frequency of contact.

The unnamed ditch flows into Finley Creek which empties into Big Eagle Creek. Big Eagle Creek ultimately flows into Big Eagle Creek Reservoir which is one of the drinking water sources for Indianapolis. If contaminants reach the reservoir then users of the reservoir could be at risk.

Approach

The concentration of contaminants found in the environmental media during the remedial investigation as well as

Table 6-3
POTENTIAL EXPOSURE PATHWAYS

	Release Source	Transport Media	Exposure Point	Exposure Route	Potential Population Exposed
1	Fugitive Dust	Air	Onsite and Offsite	Inhalation	Human-current and future
		Air	Onsite and Offsite	Ingestion	Human-current and future
2	Volatilization from soil	Air	Onsite and Offsite	Inhalation	Human-current and future
3	Site runoff	Surface Water	Unnamed ditch/ Finley Creek/ Eagle Creek	Direct contact (dermal absorption)	Human-current and future
4	Site runoff	Surface Water	Unnamed ditch/ Finley Creek/ Eagle Creek	Inhalation of vola-tilize compounds (intermedia transfer to air)	Human-current and future
5	Site runoff	Surface Water (fish)	Unnamed ditch/ Finley Creek/ Eagle Creek	Ingestion of fish	Human-current and future
6	Site runoff	Surface Water	Unnamed ditch/ Finley Creek/ Eagle Creek	Direct contact/ ingestion	Fish and other aquatic species
7	Soil	Direct contact	Onsite	Dermal absorption	Human-current and future
8	Soil	Direct contact	Onsite	Ingestion	Human-current and future
9	Soil	Direct contact	Onsite	Ingestion	Terrestrial species
10	Groundwater	Discharge to surface water	Unnamed ditch/ Finley Creek/ Eagle Creek	Same as #3, 4, 5, 6	
11	Groundwater	Direct Use (wells)	Onsite	Ingestion	Human-current and future
12	Groundwater	Direct Use (wells)	Onsite	Inhalation	Human-current and future
13	Groundwater	Direct Use (wells)	Onsite	Dermal Absorption	Human-current and future
14	Groundwater	Direct Use (wells)	Offsite	Same as #11, 12, 13	Human-current and future

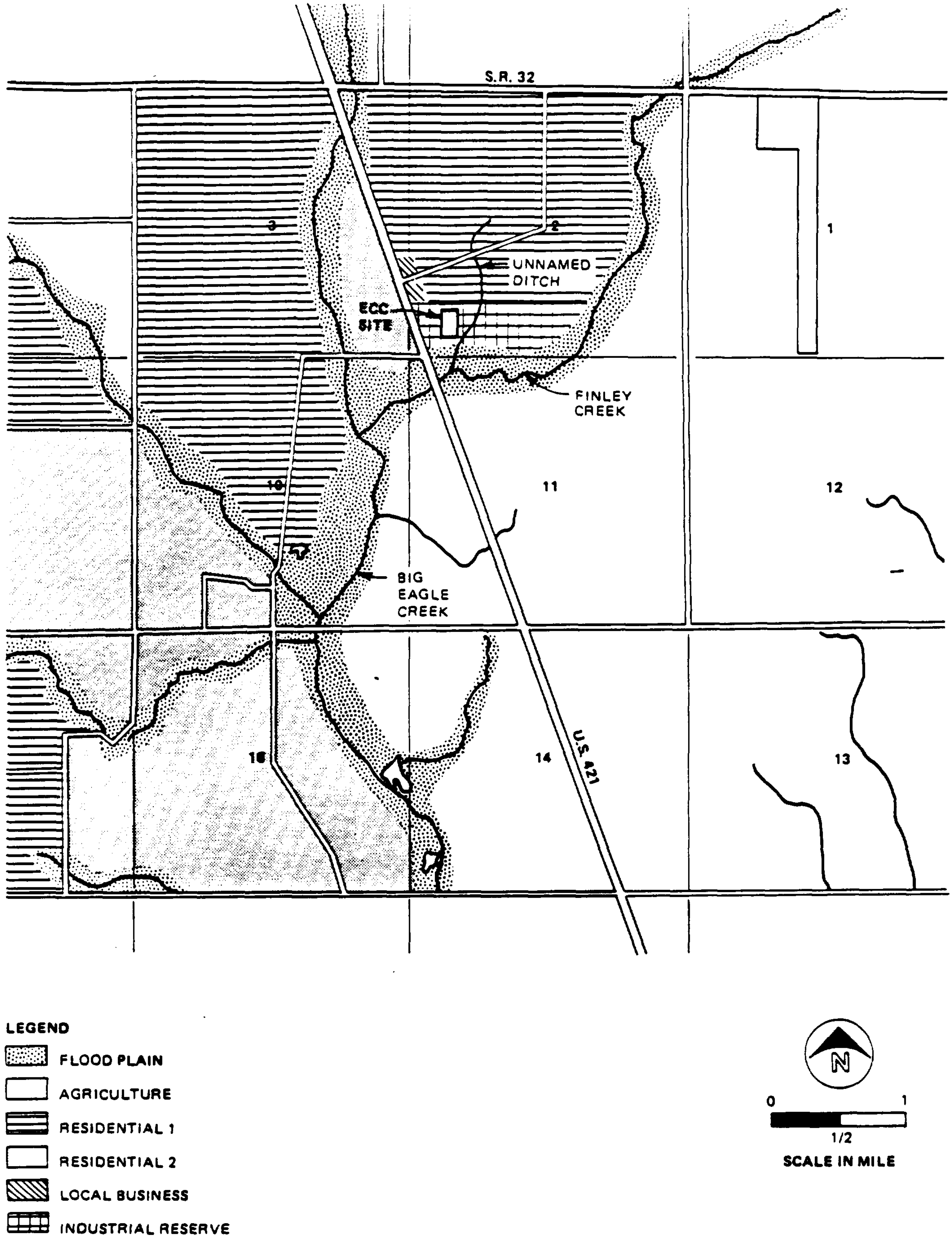


FIGURE 6-1
ZONING ADJACENT TO ECC IN UNION TOWNSHIP
ECC RI

concentrations of contaminants projected (see Chapter 5) for those media on the basis of the environmental fate and transport are used in this evaluation. Complete exposure routes are assessed using both present and predicted concentrations of contaminants at exposure points.

The concentration of chemicals at exposure points is compared to relevant or applicable standards, criteria, and guidelines where appropriate. These include the Safe Drinking Water Act Maximum Contaminant Levels (MCL's), and Clean Water Act Ambient Water Quality Criteria.

The exposed population's current and projected intake of selected compounds is estimated. This is performed for carcinogenic compounds and toxicants (noncarcinogens).

For the carcinogens present that are given cancer potencies by the U.S. EPA Carcinogen Assessment Group (CAG)(U.S. EPA, December 1984), an excess lifetime cancer risk is calculated by each appropriate exposure route. Excess lifetime cancer risk is defined as the incremental increase in the probability of getting cancer compared to the probability if no exposure occurred. For example, a 10^{-6} excess lifetime cancer risk would represent the risk resulting from an exposure that would increase cancer incidence by one case per million people exposed. The equation used for the estimation of excess lifetime cancer risk assessments is:

$$\text{Risk} = 1 - \exp(-[\text{dose} \times \text{cancer potency}])$$

The use of this equation for computing risk is presented in Appendix D.

A comparison is made, by exposure route, between the projected intakes for the potentially exposed population and the acceptable intakes for each toxicant (noncarcinogen) for which an acceptable daily intake (ADI) has been established. An ADI is the amount of toxicant (in mg/day for a 70 kg person) that is not anticipated to result in any adverse effects after chronic exposure to the general population including sensitive subgroups (Dourson, Stara, 1983).

Some compounds do not have ADI's, cancer potencies, or standards and criteria. Of these compounds, those which are in significant concentrations or are of toxicological/public health importance are examined qualitatively.

Two exposure settings are defined to estimate the potential risks from development and use of the site and the areas adjacent. The residential setting assumes the potential for construction of residences at or adjacent to the site. This includes excavation of contaminated subsoil which could be placed into a garden or child play area. Residents could inadvertently ingest contaminated soil during outside activities and soil could be transported into the home on hands, clothing, or by pets. Exposure to soil, however, is limited by weather conditions. It is assumed that the shallow groundwater below the site is used for domestic wells.

The adult worker setting assumes that a light industrial or commercial development occurs at the site. As in the residential setting, subsurface soil may be excavated during the construction and left on the surface and the shallow groundwater is used for wells. The workers are assumed to spend a significant part of their day in outdoor activities, but their exposure to the soil is also limited by weather as well as duration of work periods.

Limitations

When assessing public health risk it is reasonable to be conservative and assess upper bound situations. The risk assessment process uses specific assumptions, generalizations and recognized standard estimations. These assumptions and estimations are listed in Table 6-4.

The risk assessment process involves considerable uncertainty. The uncertainty is derived from availability of data, scientific judgments and assumptions that may or may not accurately reflect actual conditions. A listing of these uncertainty factors is presented in Appendix D.

SOIL

The soil assessment is limited to subsurface soil exposure. Exposure to contaminated subsurface soils could only occur if the site is developed and soils are excavated. There is indirect evidence from the site surface water data that the "clean cover" of imported material in the northern area of the site may be contaminated. Without soil data this surface material cannot be assessed.

The ECC site was separated into two areas, northern (covered by imported material) and southern (covered by cement pad) (see Figure 4-2), for the evaluation of potential exposure of the public to site contaminants in the subsurface soils. The analysis is based on average and maximum contaminant concentrations found in the soil test pits in the northern area and the soil borings in the southern area.

For assessing the exposure to contaminated soil, the residential lifetime soil ingestion rate is estimated as 0.013 g/kg body weight/day (about 9 ounces per year) and the occupational lifetime soil ingestion rate is estimated as 0.00013 g/kg body weight/day (about one-tenth ounce per year). Adult soil ingestion could be as low as zero. It is

Table 6-4 (Page 1 of 2)
RISK ASSESSMENT ESTIMATION AND ASSUMPTIONS

Assumption or Estimation	Comment
Exposure constant over 70 years	Conservative assumption.
Concentration of contaminants constant over 70 years	Conservative assumption. Not all degradation rates are available.
Absorbed dose equal to 100% of amount ingested	Values for absorption efficiency are not readily obtainable. Using absorption efficiency as low as 25 percent would not reduce the excess lifetime cancer risk level by an order-of-magnitude.
Years in lifetime = 70 Adult body weight = 70 kg Adult water consumption - 2L/day	U.S. EPA standard values used in deriving risk
Soil consumption: 10 grams/day/ - "pica" child; 1 gram/day/average child; 0.1 gram/day/adult; 0.5 gram/day/adult worker.	Based on work of Kimbrough, et. al. (1984), and Schaum (U.S. EPA, 1983).
For carcinogens: lifetime average water ingestion rate(LAWI)=0.035 L/kg-body weight/day; lifetime average soil ingestion rate (LASI)=0.028 g/kg body weight/day	These are age and time weighted rates over a 70 year lifetime to account for the relatively higher ingestion rates per kg of body weight in younger age classes (see Appendix D).
Correction of LASI to account for climatic influence: 0.013 g/kg body weight/day for residential setting; 0.00013 g/kg body weight/day for occupational setting.	See Appendix D.
In calculating downstream concentrations of contaminant dilution is only mechanism for reducing concentration.	Conservative assumption. Actually volatilization would be the major environmental fate of volatile compounds.

Table 6-4 (Page 2 of 2)

Assumption or Estimation	Comment
The site has the potential for unrestricted future residential and commercial development.	Part of the definition of no action.
In assessing projected release of contaminants from soil to groundwater, the contaminants are treated as if they release at the same rate.	The actual release ratio vary by contaminant due to physical and chemical characteristics.
No degradation in groundwater.	Conservative assumption to assess upper bound risk.
Contaminants release at the same rate from groundwater to surface water.	The actual release rates vary due to physical and chemical characteristics. Assumption made to keep assessment simple.
Maximum concentrations in groundwater are resprentative of entire zone.	Conservative assumption to assess upper bound risk.
Values of less than quantification limit are treated as if they are equal to the quantification limits.	Conservative assumption to assess upper bound risk.
Dilution of groundwater to unnamed ditch is 1:600.	Based on estimated groundwater flow and estimated flow in the unnamed ditch.
Dilution of unnamed ditch to Finley Creek ranges from 1:2 to 1:40 and the dilution of Finley Creek to Eagle Creek ranges from 1:40 to 1:130.	Based on limited USGS stream gaging.
No volatilization of compounds in surface water.	Conservative assumption to assess upper bound risk. Volatilization is likely.

assumed that exposure to contaminated soil is limited by climatic conditions such as precipitation, or frozen ground. In this area of Indiana, conditions suitable to limit exposure occur 53 percent of the year (NOAA, 1980). See Table 6-4 for exposure assumptions and Appendix D for a more detailed description of derivation of soil exposures.

Ingestion

If the site is developed, outdoor activity on or adjacent to the site by people and pets provides access to contaminated soils. Contaminanted soil may be airborne during dry periods and adhere to hands and clothing, or it can be inhaled and inadvertently ingested.

A summary of the estimated risks attributed to ingestion of contaminated soil is shown in Table 6-5 (see Appendixes D and E for more detail on the derivation of risks). For example, the excess lifetime cancer risk for a residential setting from the soils in the northern portion of the ECC site could be 4×10^{-3} for maximum concentrations and 4×10^{-4} for average concentrations. The primary chemicals contributing to the risk are tetrachloroethene, trichloroethene, and PCB's.

Estimated daily chemical intakes in Table 6-6 show that xylenes, lead, and ethylbenzene exceed published Acceptable Daily Intakes (ADI's) at the ingestion rate of 10 grams of soil per day and xylenes and lead exceed ADI's at the 1 gram per day ingestion rate.

Dermal Absorption

The amount of soil that comes in contact with human skin depends on factors such as behavior, soil type, weather conditions, and exposed skin area. These factors are highly variable, therefore estimation of dermal soil contact is difficult. Additionally, dry absorption rates for the variety of compounds found in the soil are not available. The data that do exist are based primarily on animal studies and extrapolated to humans which introduces uncertainty because of differences in skin properties. Because of these factors, a quantification of risk associated with dry absorption of compounds in soil is impractical. Only the qualitative statement that dermal exposure could increase risk can be made.

Dust Inhalation

Variables such as wind erosion, the organic content of soil, exposed surface area, and body absorption mechanisms make quantification of risk from dust inhalation difficult and

Table 6-5 (Page 1 of 2)
SUMMARY OF EXCESS LIFETIME CANCER RISK FROM INGESTION OF SOIL
FROM THE ECC SITE

Contaminant Concentration Scenario	Setting	Location	Major Chemicals of Concern	Total Excess Lifetime Cancer Risk
Maximum	Residential	Southern Area Intermediate Soil Depth	Chloroform Tetrachloroethene Trichloroethene	4×10^{-5}
Maximum	Occupational	Southern Area Intermediate Soil Depth	Chloroform Tetrachloroethene Trichloroethene	4×10^{-7}
Average	Residential	Southern Area Intermediate Soil Depth	Chloroform Tetrachloroethene Trichloroethene	8×10^{-6}
Average	Occupational	Southern Area Intermediate Soil Depth	Chloroform Tetrachloroethene Trichloroethene	8×10^{-8}
Maximum	Residential	Southern Area Deep Soil Depth	Trichloroethene Chloroform Tetrachloroethene	3×10^{-8}
Maximum	Occupational	Southern Area Deep Soil Depth	Trichloroethene Chloroform Tetrachloroethene	3×10^{-10}
Average	Residential	Southern Area Deep Soil Depth	Trichloroethene Chloroform Tetrachloroethene	6×10^{-9}
Average	Occupational	Southern Area Deep Soil Depth	Trichloroethene Chloroform Tetrachloroethene	6×10^{-11}

Table 6-5 (Page 2 of 2)

Contaminant Concentration Scenario	Setting	Location	Major Chemicals of Concern	Total Excess Lifetime Cancer Risk
Maximum	Residential	Northern Area Shallow Soil Depth	PCB Trichloroethene Tetrachloroethene	4×10^{-3}
Maximum	Occupational	Northern Area Shallow Soil Depth	PCB Trichloroethene Tetrachloroethene	4×10^{-5}
Average	Residential	Northern Area Shallow Soil Depth	PCB Trichloroethene Tetrachloroethene	3×10^{-4}
Average	Occupational	Northern Area Shallow Soil Depth	PCB Trichloroethene Tetrachloroethene	3×10^{-6}
Maximum	Residential	Northern Area Intermediate Soil Depth	PCB's Arsenic	8×10^{-4}
Maximum	Occupational	Northern Area Intermediate Soil Depth	PCB's Arsenic	8×10^{-6}
Average	Residential	Northern Area Intermediate Soil Depth	PCB's Arsenic	2×10^{-5}
Average	Occupational	Northern Area Intermediate Soil Depth	PCB's Arsenic	2×10^{-7}

Table 6-6
SUMMARY OF COMPOUNDS EXCEEDING ACCEPTABLE DAILY INTAKE
FROM SOIL INGESTION AT THE ECC SITE

Location	Chemical	ADI (ug/day)	Maximum Concentration ug/kg	Daily Chemical Intakes Using Maximum Concentrations: @ 10 gm Soil/Day (ug/day)	@ 1 gm Soil/Day (ug/day)	@ 0.1 gm Soil/Day (ug/day)	Minimum Concentration ug/kg	Average Chemical Intakes Using Average Concentrations: @ 10 gm Soil/Day (ug/day)	@ 1 gm Soil/Day (ug/day)	@ 0.1 gm Soil/Day (ug/day)
South Pad Intermediate Depth	[a]		-				-			
South Pad Deep Depth	[a]		-				-			
North Test Pits Shallow Depth	Ethylbenzene	9,500	1,500,000	15,000	1,500	150	145,800	1,458	149	15
	Xylenes	1,200	6,800,000	68,000	6,800	680	629,900	6,299	630	63
	Lead	100	376,200	3,762	376	38	71,700	717	72	7
North Test Pits Intermediate Depth	Cadmium	170	27,000	270	27	3	3,900	39	4	0.4
	Lead	100	415,200	4,152	415	41	60,200	602	6	6

[a]Compounds present did not exceed ADI.

wjr/GLT90/13

tenuous. Only the qualitative statement that exposure through dust inhalation could increase risk can be made.

SEDIMENT

For the assessment of human exposure to sediment, the unnamed ditch and the Finley Creek sampling points are treated as separate exposure points. The analysis is based on maximum sediment contaminant concentrations attributable to the ECC site at each point. The maximum concentrations are used due to the limited number of sample points. It is assumed that residences and work places are or could be adjacent to areas of contaminated sediment and sediment may not be covered by water during low flow periods of the year.

As with soils, both residents and adult workers in the area, could incur health risks resulting from exposure to contaminated sediment during outside activities, or if sediment is transported into houses on hands, clothing, or by pets. The ingestion rates developed for soils are also used for sediments.

Ingestion

As a result of outdoor activity adjacent to the streams and river, people and pets have access to contaminated sediment. Contaminated sediment may be airborne during dry periods and adhere to hands and clothing or be ingested.

A summary of the estimated risks attributed to ingestion of contaminated sediments is shown in Table 6-7, (see Appendixes D and E for more detail on the derivation of the risks.) For example, the excess lifetime cancer risk for the residential setting near sampling point 004 in Finley Creek is 2×10^{-11} for maximum concentrations. The primary chemical contributing to the risk is methylene chloride. Estimated daily chemical intakes in Table 6-8 show that lead exceeds a derived ADI at sampling point 004.

Dermal Absorption and Dust Inhalation

The same restrictions on the quantification of risk for the dermal absorption and inhalation of soils also is true for sediments.

GROUNDWATER

Groundwater is a major transport and release media for contaminants from the ECC site. The shallow saturated zone and the shallow sand gravel aquifer are the two portions of the groundwater impacted by contaminants from the ECC site. Over 40 compounds are found in the groundwater with the volatile compounds being of most concern. Any risk from

Table 6-7
SUMMARY OF EXCESS LIFETIME CANCER RISK
FROM EXPOSURE TO SEDIMENT FROM ECC SITE

Contaminant Concentration Scenario	Setting	Location	Major Chemicals of Concern	Total Excess Lifetime Cancer Risk
Maximum	Residential	003	Methylene Chloride	$5 \times 10^{\cancel{-4}\ -11}$
Maximum	Occupational	003	Methylene Chloride	$5 \times 10^{\cancel{-3}\ -12}$
Maximum	Residential	004	Methylene Chloride	2×10^{-11}
Maximum	Occupational	004	Methylene Chloride	2×10^{-13}
Maximum	Residential	005	Methylene Chloride	7×10^{-11}
Maximum	Occupational	005	Methylene Chloride	7×10^{-13}

wjr/GLT90/15

see Appendix E

Table 6-8
SUMMARY OF COMPOUNDS EXCEEDING ACCEPTABLE DAILY INTAKE
FROM SEDIMENT INGESTION AT THE ECC SITE

				Daily Chemical Intakes Using Maximum Observed Concentrations		
Location	Chemical	ADI (ug/day)	Maximum Concentration ug/kg	@ 10 gm Soil/Day (ug/day)	@ 1 gm Soil/Day (ug/day)	@ 0.1 gm Soil/Day (ug/day)
SD003	[a]		-			
SD004	Lead	100	15,500	155	15	1
SD005	[a]		-			

[a]Compounds present did not esceed ADI.

wjr/GLT90/28

groundwater comes from it's direct use or the discharge of groundwater to surface waters. Direct use of groundwater would include either consumption for drinking and cooking or from bathing. The discharge of groundwater to surface water is addressed in the surface water section.

The current population at risk are the users of one domestic well down gradient from the site, but prior to the discharge of the aquifer to Finley Creek. Domestic well sample results do not show any evidence of contaminants reaching this well. It would appear that this exposure pathway is currently incomplete.

Because of this, only future groundwater use, either residential or occupational, is considered. The size of the population that could use the groundwater would be limited by the relatively small area underlain by the aquifer between the ECC site and the aquifers discharge to surface water.

Risks are based on current data from the RI and projected release of contaminants from the soil to the groundwater as estimated in Chapter 5. Well Nos. 8A, 9A, and 10A represent the shallow sand and gravel aquifer and well No. 11A represents the shallow saturated zone (see Appendix E). For both zones, contaminant concentrations found during the RI in these wells are used to estimate risk under current conditions. The projected releases to the shallow saturated zone are used to estimate risk under future conditions in that aquifer. The maximum concentrations are used from the RI data and maximum and average concentrations are used for the projected releases to the groundwater.

Appendix D presents derivation of ingestion and dermal absorption exposures. Appendix E presents the risk assessment for the groundwater in detail. A summary is presented below.

Comparison to Standards, Criteria, and Guidelines

Table 6-9 compares the maximum value for each compound found in wells representing the onsite aquifers (both shallow saturated zone and shallow sand and gravel)to relevant or applicable standards, criteria, and guidelines for the consumption of water.

Iron exceeds the secondary MCL, which is not a health based standard. This level is also found in the upgradient wells and represent areawide concentrations. 1,1-dichloroethene and trichloroethene exceed the proposed MCL's and the AWQC 10^{-6} cancer risk levels. Methylene chloride and tetrachloroethene exceed the AWQC 10^{-6} cancer risk level. Trichloroethene also exceeds the chronic health advisory level.

Table 6-9

COMPARISON OF GROUNDWATER TO STANDARDS AND CRITERIA

Compound	Maximum Concentration[a]	SDWA[b] MCL Primary	SDWA[c] MCL Secondary	AWQC[d] Toxicity	AWQC[e] 10-6	Health[f] Advisory	Criteria Exceeded
SHALLOW SAND AND GRAVEL AQUIFER:							
Barium	353	1,000	-	-	-	-	Y
Chromium	13	50	-	50	-	-	N
Iron	2,545	-	300	-	-	-	Y
Manganese	40	-	50	-	-	-	N
Nickel	46	-	-	15.4	-	-	Y
1,1-dichloroethene	8	7[(h)]	-	-	0.033	70[(j)]	Y
Methylene chloride	64	-	-	-	0.19	150[(j)]	Y
Tetrachloroethene	9	-	-	-	0.8	20[(j)]	Y
Trichloroethene	21	5[(h)]	-	-	2.8	75[(j)]	Y
SHALLOW SATURATED ZONE - CURRENT CONCENTRATIONS:							
Trichloroethene	28,000	5[(h)]	-	-	2.8	75[(j)]	Y
SHALLOW SATURATED ZONE - PROJECTED CONCENTRATIONS:							
Chloroform	10,000(400)	100[(i)]	-	-	0.19	-	Y
Methylene chloride	7,000,000(200,000)	-	-	-	0.19	150[(j)]	Y
1,1,1-trichloroethane	2,000,000(80,000)	200[(h)]	-	-	1,900	100[(j)]	Y
1,1,2-trichloroethane	2,000(50)	-	-	-	0.6	-	Y
Tetrachloroethene	100,000(8,000)	-	-	-	0.8	20[(j)]	Y
Trichloroethene	600,000(200,000)	5[(h)]	-	-	2.8	75[(j)]	Y
Toluene	300,000(60,000)	-	-	15,000	-	340[(j)]	Y
Ethylbenzene	80,000(10,000)	-	-	24,000	-	-	Y
Phenol	8,000,000(150,000)	-	-	-	3,500	-	Y
PCB	150(50)	-	-	-	0.0006	-	Y

[a] All values in ug/L
[b] Safe Drinking Water Act Primary Maximum Contaminant Level
[c] Safe Drinking Water Act Secondary Maximum Contaminant Level
[d] Ambient Water Quality Criteria - Toxicity Protection
[e] Ambient Water Quality Criteria - 10-6 Cancer Risk
[f] Health advisory for protection of most sensitive population
[g] Organoleptic criteria
[h] Proposed MCL's
[i] MCL for trihalomethanes
[j] Chronic
[k] 10 Day

NOTE: Concentrations in ( ) are average projected release concentrations.

Projected concentration of chloroform, trichloroethene, methylene chloride, tetrachloroethene, 1,1,1-trichloroethane, 1,1,2-trichloroethane, toluene, ethyl benzene, phenol and PCB also would exceed standards and criteria.

Ingestion

Ingestion of groundwater could occur in both residential and occupational settings. Table 6-10 summarizes the risk assessment for the ingestion of the groundwater. In all settings, the excess lifetime cancer risk is greater than 1×10^{-6} with risk associated with projected concentrations in the shallow saturated zone exceeding 1×10^{-3}. Use of the shallow saturated zone and the shallow sand and gravel aquifer at the site could represent a potential public health risk without remedial action.

It is unlikely that the shallow saturated zone groundwater would be used as a water source due to the low hydraulic conductivity of this zone. The shallow confined aquifer would more likely be used. No new loadings into this zone are expected because of the upward gradient in this aquifer. It is possible that the concentration will decrease with time due to degradation. Because of that, the risk may be actually less.

Dermal Absorption

The dermal absorption of contaminants from groundwater would occur during bathing or showering. This would occur under the residential setting. Occupational showering and bathing would be very limited and is therefore not assessed.

A variety of factors can affect exposure from skin absorption including concentration, temperature, hydration of skin, duration and frequency of exposure. Skin absorption rates for most chemicals do not exist, and rates that do exist are for almost pure substances or high concentration aqueous solutions. The rates are often based on laboratory animal studies. While it is difficult to assess dermal absorption for many contaminants, it is possible to assess the absorption of volatile compounds (see Appendix D). The bathing risk estimation assumes that all of the compounds remain in the water phase and do not volatilize.

The risks are summarized in Table 6-11. The risk associated with bathing is roughly equal to the risk from ingestion and are greater than 1×10^{-6}. In both exposures, the volatile compounds are the chemicals of concern.

Under no action, bathing could represent a potential public health threat. However, by not accounting for volatilization, dermal absorption risks may be an overestimation.

Table 6-10
SUMMARY OF EXCESS LIFETIME CANCER RISK AND ACCEPTABLE DAILY INTAKE COMPARISONS
INGESTION OF GROUNDWATER AT THE ECC SITE

Contaminant Concentration Scenario	Setting	Aquifer	Major Chemical(s) of Concern	Total Excess Lifetime Cancer Risk	ADI Exceeded ?
Current Values	Residential	Shallow Saturated Zone	Trichloroethene	2×10^{-2}	Trichloroethene
	Occupational	Shallow Saturated Zone	Trichloroethene	3×10^{-3}	Trichloroethene
Current Values	Residential	Shallow Sand and Gravel	1,1 Dichloroethene Tetrachloroethene Trichloroethene	7×10^{-5}	No
Current Values	Occupational	Shallow Sand and Gravel	1,1 Dichloroethene Tetrachloroethene Trichloroethene	1×10^{-5}	No
Projected Values (Maximum)	Residential	Shallow Saturated Zone	Methylene Chloride Tetrachloroethene Trichloroethene Chloroform PCB	8×10^{-1}	1,1,1-trichloroethane Toluene Ethylbenzene Phenol Trichloroethane Methylene chloride
Projected Values (Maximum)	Occupational	Shallow Saturated Zone	Methylene Chloride Tetrachloroethene Trichloroethene Chloroform PCB	2×10^{-2}	1,1,1-trichloroethane Toluene Ethylbenzene Phenol Trichloroethane Methylene chloride
Projected Values (Average)	Residential	Shallow Saturated Zone	Methylene Chloride Tetrachloroethene Trichloroethene Chloroform PCB	1×10^{-1}	1,1,1-trichloroethane Toluene Ethylbenzene Phenol Trichloroethane Methylene chloride
Projected Values (Average)	Occupational	Shallow Saturated Zone	Methylene Chloride Tetrachloroethene Trichloroethene Chloroform PCB	5×10^{-3}	1,1,1-trichloroethane Phenol Trichloroethane Methylene chloride

Table 6-11
SUMMARY OF EXCESS LIFETIME CANCER RISK
DERMAL ABSORPTION OF GROUNDWATER AT THE ECC SITE

Contaminant Concentration Scenario	Aquifer	Major Chemical of Concern	Excess Lifetime Cancer Risk
Current Values	Shallow Sand and Gravel	1,1 Dichloroethene Trichloroethene	7×10^{-5}
Current Values	Shallow Saturated Zone	Trichloroethene	2×10^{-2}
Projected Values (Maximum)	Shallow Saturated Zone	Trichloroethene Methylene Chloride Tetrachloroethene Chloroform	7×10^{-1}
Projected Values (Average)	Shallow Saturated Zone	Trichloroethene Methylene Chloride Tetrachloroethene Chloroform	3×10^{-2}

GLT533/9

Vapor Inhalation

Vapors may be released from groundwater during use because of physical agitation of the groundwater or water temperatures raised above the volatilization point of the compound. This could occur in a variety of ways including bathing and cooking.

To model vapor release is difficult and information is lacking on human inhalation and retention efficiencies for individual chemical, therefore, it is not practical to estimate exposures and risk associated with this exposure route. Only the qualitative statement that exposure may occur and increase risk can be made.

SURFACE WATER

The groundwater discharges to the unnamed ditch and Finley Creek. The surface water is a major release pathway for contaminants to leave the site. Fourteen compounds were found at the Finley Creek downstream sampling point (004) (see Tables 4-17 and 4-18). The volatile organic compounds are of greatest concern in terms of risk.

In addition to the measured concentrations in Finley Creek, it is possible to predict concentration in the surface water based on the projected concentration of contaminants in the shallow saturated zone (from Chapter 5) and anticipated dilution with surface water. Dilutions are based on estimates of groundwater discharge to the unnamed ditch and Finley Creek, and USGS stream flow measurements for the unnamed ditch, Finley Creek, and Eagle Creek (see Table 6-4). Based on this information risks associated with exposures at the unnamed ditch, Finley Creek and Eagle Creek can be assessed.

The exposures that could occur at the surface waters would include direct exposure through wading via dermal absorption, and inhalation of volatile organics and indirect exposure by consumption of fish that have bioconcentrated contaminants from the surface water. Risks based on current concentrations in Finley Creek and projected concentrations in the unnamed ditch, Finley Creek, and Eagle Creek are assessed. These exposures are assessed detail in Appendix E and are summarized below.

Comparison to Standard

The current concentrations found in Finley Creek at SW004 and the projected concentration of contaminants in the unnamed ditch, Finley Creek and Eagle Creek are compared to the ambient water quality criteria for ingestion of aquatic organisms in Table 6-12. The concentration currently found at Finley do not exceed the criteria.

Table 6-12
COMPARISON OF SURFACE WATER CONCENTRATION TO AMBIENT WATER QUALITY CRITERIA FOR INGESTION OF AQUATIC ORGANISMS

Compound	Current Concentration at SW004 ug/L	Projected Concentration in Ditch ug/L	Projected Concentration in Finley Creek ug/L Maximum	Projected Concentration in Finley Creek ug/L Minimum	Projected Concentration in Eagle Creek ug/L Maximum	Ambient Water Quality Criteria-Ingestion of Aquatic Organism ug/L
1,1,1 Trichloroethane	120	100	50	5	1.2	1,030,000[a]
1,1 Dichloroethane	45	-	-	-	-	-
Chloroethane	12	-	-	-	-	-
1,2 Transdichloroethane	330	-	-	-	-	-
Tetrachloroethene	<5	10	6	0.6	0.14	8.85[b]
Trichloroethene	67	300	100	10	2.4	80.7[b]
Vinyl Chloride	10	-	-	-	-	525[b]
O-Xylene	<5	-	-	-	-	-
Methylene Chloride	-	400	100	10	2.4	15.7[b]
Toluene	-	100	30	3	0.7	424,000[a]
Aluminum	490	-	-	-	-	-
Iron	1,410	-	-	-	-	-
Manganese	130	-	-	-	-	-
Cyanide	0.008	-	-	-	-	200[a]
1,1,2-trichloroethane	-	0.08	.03	.003	0.0007	41.8[b]
Phenol	-	300	60	2	1.4	769,000[a]
Chloroform	-	0.6	0.2	0.02	0.005	15.7[b]
Ethylbenzene	-	20	6	0.6	0.14	3,280[a]

[a]Based on toxicity.
[b]Represents a 10^{-6} cancer risk level.

GLT424/141

The projected concentrations do exceed the ambient water quality criteria 10^{-6} cancer risk for tetrachloroethene, trichloroethene and methylene chloride in the unnamed ditch. The maximum projected concentration (i.e., lowest dilution) of methylene chloride and trichloroethene exceed the 10^{-6} level in Finley Creek.

Dermal Absorption

Residents and visitors could be exposed to volatile chemicals in the surface water by wading in the unnamed ditch, Finley Creek and Eagle Creek during the warmer months of the year. Assumptions concerning wading appear in Appendix D. The actual population currently at risk is unknown but expected to be small. The area is growing and the population exposed could increase. The risks are summarized in Table 6-13. Wading in these waterways does not exceed 1×10^{-6} excess lifetime cancer risk.

Ingestion Via Fish Consumption

Fish have been observed in Finley and Eagle Creek. Human exposure to contaminants could occur from consumption of fish that are caught if the fish have bioconcentrated surface water contaminants. There were no fish samples taken, therefore, literature values for bioconcentration factors are used.

The current concentration measured in Finley Creek and as the projected concentrations for the unnamed ditch, Finley Creek, and Eagle Creek are assessed. The projected discharge of PCB to the surface water is not included in the assessment because the time frame for the migration of PCB's from soil to surface water via groundwater discharge would be orders-of-magnitude greater than the other compounds. The results are summarized in Table 6-14.

The excess lifetime cancer risk from fish ingestion under the current concentrations in Finley Creek is 1×10^{-6}. The projected values for the unnamed ditch and Finley Creek (under the least dilution) are slightly greater than 1×10^{-6}.

This risk estimation relies on a number of assumptions (see Appendix E and Table 6-4) and projected values such that the risks presented represent a conservative upper bound. It is unlikely that a sufficient number of fish are residing in the unnamed ditch to make the analysis realistic. It is also unlikely that both fish and fishermen would be restricted to one stream segment. The approach that is taken, is taken for simplicity sake and it's limitations are recognized.

Table 6-13
SUMMARY OF EXCESS LIFETIME CANCER RISK
FROM WADING - ECC

CURRENT CONDITIONS

Location	Risk
Finley Creek	5×10^{-7}

PREDICTED CONDITIONS[a]

Location	Risk
Unnamed Ditch	1×10^{-6} [b]
Finley Creek	7×10^{-7} [c]
Eagle Creek	2×10^{-8} [d]

[a] Based upon the projected contaminant concentrations released to the groundwater from the soil.
[b] Assume 1:600 groundwater to ditch water dilution.
[c] Assume 1:2 ditch to Finley Creek dilution.
[d] Assume 1:41 Finley Creek to Eagle Creek dilute.

GLT424/137

Table 6-14
SUMMARY OF EXCESS LIFETIME CANCER RISK
FROM CONSUMPTION OF FISH IN THE WATERWAYS AT THE ECC SITE

Location	Scenario	Risk
Finley Creek	Actual Concentration	1×10^{-6}
Unnamed Ditch	Projected Concentration	6×10^{-6}
Finley Creek	Projected Concentration (Least dilution)	3×10^{-6}
Finley Creek	Projected Concentration (Greatest dilution)	3×10^{-7}
Eagle Creek	Projected Concentration (Least dilution)	5×10^{-8}

GLT424/145

ENVIRONMENTAL ASSESSMENT

INTRODUCTION

This environmental assessment describes the current site situation and the environmental conditions anticipated if no remedial action is taken. This assessment identifies habitats that are or could become contaminated, the types of impacts that are likely and assesses the general significance of the impacts.

Population at Risk

The population at risk would be the terrestrial and aquatic animal species and associated plant communities that reside on or include the ECC site and adjacent areas as part of their range. This would include species that permanently reside in the area as well as transient species. The population at risk and their route of exposure include:

- o Aquatic organisms, through contamination of surface waters from runoff or discharges into them.
- o Local vegetation through contact with contaminated sediment or dust.
- o Local fish, wildlife, and domestic animals, through contact with or ingestion of contaminated vegetation, soil, sediment, or surface water.

The area is former agricultural land with second growth plant communities in the fields and dense plant growth along the waterways. The ECC site drains into the riverine type wetlands that are comprised of the unnamed ditch, Finley Creek and Eagle Creek. There are no known designated critical habitats for threatened or endangered species that are impacted by the ECC site. There are no known endangered species that inhabit the area around the ECC site.

Several of the compounds, trichloroethene and tetrachloroethene are known to bioconcentrate. Food chain affects could occur if fish are eaten by terrestrial organisms.

SOIL AND SEDIMENT

Some of the organic contaminants found in soil and sediment bioaccumulate and tend to stay in the fatty tissue of animals once ingested. Eight of the inorganics found in the soil (arsenic, cadmium, chromium, copper, cyanide, nickel, lead, and mercury) and three of the inorganics found in the sediment (cyanide, mercury, and lead) tend to adsorb on clay and organic particles in the soil or sediment which ultimately may be deposited on plants as dust. Animals may also inadvertently ingest contaminated soil or exposed sediment while grooming and feeding. Some of the compounds may be taken up by plants and ultimately eaten by animals both of which may or may not be adversely affected.

SURFACE WATER

The discharge of contaminanted groundwater would have the greatest potential impact on the aquatic environments. To a lesser extent surface runoff would also affect the aquatic environments. The Depauw University study on trophic composition of the fish population suggests an impact on the aquatic population in Finley Creek (see Chapter 3). This impact can not be conclusively associated with the ECC site, however. The State of Indiana's mussel bioaccumulation study was inconclusive (see Chapter 3).

Table 6-15 compares concentrations found at sampling point 004 and projected concentrations in the unnamed ditch, Finley Creek and Eagle Creek to ambient water quality criteria and 96 hour LC_{50} values. Concentrations do not exceed either LC_{50} values or water quality criteria for protection of aquifer life under any of the conditions assessed .

SUMMARY

The major public health and environmental risks from the ECC site derived in this endangerment assessment are outlined in Table 6-16. Each risk is listed by pathway and the likelihood of the risk is assessed. The major risks come from the contaminated soil via direct contact and release of soil contaminants to the groundwater and subsequent use of groundwater for bathing and drinking water source. The current population at risk is limited and while the area is projected to grow the impact of the ECC site appears to be localized.

In conclusion, the site does pose a potential threat to the public health, welfare, and environment, and a feasibility study of remedial action to cost-effectively mitigate the site hazards should be performed.

GLT90/5

Table 6-15

COMPARISON TO AMBIENT WATER QUALITY CRITERIA AND 96 HR LC_{50}

Compound	Finley 004 Concentration ug/L	Projected Unnamed Ditch Concentration ug/L	Maximum Projected Finley Creek Concentration ug/L	Maximum Projected Eagle Creek Concentration ug/L	AWQC[c] Aquatic Protection ug/L Acute	Chronic	96 hr LC_{50}[d] ug/L
1,1,1 Trichloroethane	120	100	50	1.2	18,000	--	52,800[a]
1,1 Dichloroethane	45	--	--	--	--	--	550,000[b]
Trans 1,2 Dichloroethene					16,000	--	--
Methylene Chloride	<5	400	100	2.4		--	193,000
Tetrachloroethene	<5	10	6	0.14	5,280	840	18,400[a]
Trichloroethene	620	300	100	2.4	45,000		40,200[a]
Vinyl Chloride	10	--	--	--	--	--	--
Xylene	5	--	--	--	--	--	42,000[a]
Toluene	--	100	30	0.7	17,500		34,000[a]
Phenol	--	300	60	1.4	10,200[c]	2,560[c]	5,700[b]
Ethylbenzene	--	20	6	0.14	32,000	--	42,300[a]

[a] For flathead minnow
[b] For bluegill
[c] Ambient Water Quality Criteria listing of lowest adverse effects on aquatic life
[d] Lethal concentration 50% over 96 hour period

GLT533/14

Table 6-16 (Page 1 of 4)
SUMMARY OF MAJOR RISK FROM ENDANGERMENT ASSESSMENT
RISK/EFFECTS

Pathway	Location	Setting	Excess Lifetime Cancer Risk	Acceptable Daily Intake (ADI)	Compounds of Concern	Comment	Probability
Public Health Evaluation							
Soil - Direct contact via ingestion	South Pad - Intermediate Depth	Residential	4×10^{-5} to 8×10^{-6}	-	Trichloroethene Tetrachloroethene	Based on maximum to average concentration	Requires development of site - limited area of exposure.
Soil - Direct contact via ingestion	Northern Test Pit Area - Shallow Depth	Residential	4×10^{-3} to 3×10^{-4}	-	PCB's Trichloroethene Tetrachloroethene	Based on maximum to average concentration	Requires development of site - limited area of exposure.
Soil - Direct contact via ingestion	Northern Test Pit Area - Shallow Depth	Residential	-	ADI's exceeded at 1 gram/day ingestion rate	Xylene Lead	Based on maximum concentrations	Requires development of site - limited area of exposure.
Soil - Direct contact via ingestion	Northern Test Pit Area - Intermediate Depth	Residential	8×10^{-4} to 2×10^{-5}	-	PCB's Trichloroethene Tetrachloroethene	Based on maximum to average concentration	Requires development of site - limited area of exposure.
Soil - Direct contact via ingestion	Northern Test Pit Area - Intermediate Depth	Residential	-	ADI's exceeded at 10 grams/day ADI exceeded at 1 gram/day	Cadmium Lead Lead	Based on maximum concentrations	Requires development of site - limited area of exposure.
Sediment - Direct Contact via ingestion	Finley Creek downstream from ECC at highway 421	Residential	-	ADI exceeded at 10 gram/day	Lead	Based on maximum concentration	Requires exposure of or direct contact with sediment. Seasonally limited. Contamination cannot be directly associated with the ECC site.
Groundwater - via ingestion	Onsite - Shallow Saturated Zone	Residential - current contaminant levels	2×10^{-2} to 3×10^{-3}	ADI exceeded at 10 gram/day	Trichloroethene	Based on one sampling point	No current exposures. Requires development of site. Potential future exposed population limited by size of area and low permeability of water bearing soil. Contaminant levels may increase with time.

Pathway	Location	Setting	Excess Lifetime Cancer Risk	Acceptable Daily Intake (ADI)	Compounds of Concern	Comment	Probability
Groundwater - via ingestion	Onsite - Shallow Sand and Gravel Aquifer	Residential Occupational current contaminant levels	7×10^{-5} to 1×10^{-5}	-	1,1-Dichloroethene Tetrachloroethene Trichloroethene	Based on maximum concentrations	No current exposures based on residential well data. Limited potential future exposed population. Upward gradient should limit new contamination - concentration and risk should decline with time.
Groundwater - via ingestion	Onsite/Offsite Shallow Saturated Zone	Residential Occupational Project Maximum Values	8×10^{-1} 2×10^{-2}	ADI exceeded ADI exceeded	Methylene Chloride Tetrachloroethene Trichloroethene Chloroform PCB	Based on projected release from soil, no degradation and maximum concentration	Requires development of site surrounding area. Upper bound value based on highest soil concentrations. Actual population using groundwater would be limited by size of area and low permeability of water bearing soil.
Groundwater - via ingestion	Onsite/Offsite Shallow Saturated Zone	Residential Occupational Project Average Values	1×10^{-1} 5×10^{-3}	ADI exceeded ADI exceeded	Methylene Chloride Tetrachloroethene Trichloroethene Chloroform PCB	Based on projected release from soil, no degradation and average concentration	Requires development of site surrounding area. Upper bound value based on highest soil concentrations.
Groundwater - via dermal absorption (bathing)	Onsite - Shallow saturated zone	Residential Current contaminant levels	2×10^{-2}	-	Trichloroethene	Based on one sampling point. Assumes no volatilization.	No current exposures. Requires development of site. Potential future exposed population limited by size of area and low permeability of water bearing soil. Contaminant levels may increase with time.
Groundwater - via dermal absorption (bathing)	Onsite - Shallow and and gravel aquifer	Residential - Current contaminant levels	7×10^{-7}	-	1,1-Dichloroethene Trichloroethene	Based on maximum concentrations. Assumes no volatilization.	No current exposures based on residential well data. Limited potential future exposed population. Upwared gradient should limit new contamination concentration and risk should decline with time.
Groundwater - via dermal absorption (bathing)	Onsite/offsite shallow saturated zone	Residential Projected Maximum values	7×10^{-1}	-	Methylene Chloride Tetrachloroethene Trichloroethene Chloroform	Based on projected release from soil, no degradation, no volatilization and maximum concentration	Requires development of site/ surrounding area. Upper bound value based on highest soil concentrations. Actual population using groundwater would be limited by size of area and low permeability of water bearing soil.

Pathway	Location	Setting	Excess Lifetime Cancer Risk	Acceptable Daily Intake (ADI)	Compounds of Concern	Comment	Probability
Groundwater - via dermal absorption (bathing)	Onsite/offsite shallow saturated zone	Residential Projected Average values	3×10^{-2}	-	Methylene Chloride Tetrachloroethene Trichloroethene Chloroform	Based on projected release from soil, no degradation, no volatilization	Requires development of site/surrounding area. Upper bound value based on highest soil concentrations.
Groundwater discharge to surface water - dermal absorption from wading	Finley Creek	Actual Concentrations	5×10^{-7}	-	Trichloroethene	Based on one sampling point	Assumes concentrations remain constant. Cannot be definitly associated with ECC. Limited potential of exposed population.
Groundwater discharge to surface water - dermal absorption from wading	Unnamed Ditch Finley Creek Eagle Creek	Projected Concentrations	1×10^{-6} 7×10^{-7} 2×10^{-8}	-	Trichloroethene Tetrachloroethene Methylene Chloride	Based on projected concentrations over a range of dilutions. Assumes no volatilization.	Upper bound range of risk based on average release from soil. Limited potentially exposed population.
Groundwater discharge to surface water - fish bioconcentration of contaminants - human ingestion of fish	Finley Creek	Actual Concentrations	1×10^{-6}	-	Trichloroethene Tetrachloroethene	Based on one sampling point and literature values for BCF	Assumes: exclusive and active fishing in Finley Creek; fish reside exclusive in Finley Creek; sufficient sport fish population. Currently exposed population unknown but estimated to be small. Some comments for future.
Groundwater discharge to surface water - fish bioconcentration of contaminants - human ingestion of fish	Unnamed Ditch	Projected Concentrations	6×10^{-6}	-	Trichloroethene Tetrachloroethene Methylene Chloride Chloroform	Based on projected concentrations over a range of dilutions. Uses average soil concentration as a basis. Assumes no volatilization. Based on literature values for BCF.	Values are upper bound range. Exposed population unknown but estimated to be small. Assumes: exclusive and active fishing in creek; fish reside exclusively in creek; sufficient sport fish population. Volatilization should reduce concentration.

Table 6-16 (Page 4 of 4)

Pathway	Location	Setting	Excess Lifetime Cancer Risk	Acceptable Daily Intake (ADI)	Compounds of Concern	Comment	Probability
Groundwater discharge to surface water - fish bioconcentration of contaminants - human ingestion of fish	Finley Creek	Projected Concentrations	3×10^{-6} to 3×10^{-7}	-	Trichloroethene Tetrachloroethene Methylene Chloride Chloroform	Based on projected concentrations over a range of dilutions. Uses average soil concentration as a basis. Assumes no volatilization. Based on literature values for BCF.	Values are upper bound range. Exposed population unknown but estimated to be small. Assumes: exclusive and active fishing in creek; fish reside exclusively in creek; sufficient sport fish population. Volatilization should reduce concentration.
Groundwater discharge to surface water - fish bioconcentration of contaminants - human ingestion of fish	Eagle Creek	Projected Concentrations	5×10^{-8}	-	Trichloroethene Tetrachloroethene Methylene Chloride Chloroform	Based on projected concentrations the least of dilutions. Uses average soil concentration as a basis. Assumes no volatilization. Based on literature values for BCF.	Values are upper bound range. Exposed population unknown but estimated to be small. Assumes: exclusive and active fishing in creek; fish reside exclusively in creek; sufficient sport fish population. Volatilization should reduce concentration.

GLT533/16